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Do you agree with any of them?

There are probably few points in railway shop practice on the methods of handling upon which a wide divergence of opinion will not be found among mechanics and supervisors. The readers of this publication will recall many such points which have been discussed from a wide variety of viewpoints in its columns at various times. Probably no point has ever been raised, however, which has caused more spontaneous interest or more difference of opinion than the purely human problem presented by the failure of a workman to accept the raise offered to him for exceptional ability, which was presented by a correspondent on the Reader's Page of last month's issue. Seven discussions of the questions raised in this letter will be found in the Reader's Page in this issue. If any of our readers think that the human problems of the supervisor are secondary to, or less complicated than, the technical problems pertaining to the character of the work for which he is responsible, let them read these seven expressions of opinion and the arguments with which they are backed up. We believe they will then be inclined to revise their estimate of the relative importance of these two phases of the supervisor's responsibility. With as many shades of opinion as there are correspondents, no one can agree with them all. There is not one of them, however, which does not present something which is thought-provoking even if it cannot be "swallowed whole." The interest displayed by our readers in this discussion will determine how much longer it will be continued.

Do you get what you pay for?

There is an economic point in the life of every machine tool beyond which its continuance in service represents an actual loss. On some types of machines this point may be reached after five to seven years of service; on others in 10 to 14 years and in some cases 20 or more years. Two factors play an important part in determining a machine tool retirement and replacement policy—the demand for production output and accuracy and the cost of maintenance in service. Railroad mechanical officers, in their consideration of the machine tool problem, are vitally concerned in the latter factor and it seems possible that a proper appreciation of its significance might be of invaluable assistance in the timely and intelligent selection of new machine tool equipment.

The real cost of any machine tool is its initial cost plus the cost of maintaining it in service. A high grade, well built machine may represent a few more dollars in first cost, but because of its ability to stand up in service with lower maintenance costs will result in a lower average cost per year of service than a machine which may have represented an apparent saving in the original purchase price.

Accurate records of individual machine tool repair costs cannot help but reveal to a wide-awake shop superintendent the true condition of his shop equipment and its ability to meet the demand for increased output. In many modern plants, both in the railroad and industrial field, the accumulation of repair costs to the extent of, for example, 20 per cent of the initial cost of the machine is an immediate danger signal demanding investigation as to the causes. This may indicate that the machine is being forced beyond its capacity, and that another unit is needed to balance the "machine load" that the machine is not suited to the handling of modern high-grade steels, or that it has reached a point where a thorough overhauling is necessary. An estimate of the cost of needed repairs may bring out the fact that such an expenditure could not be justified in comparison to the cost of a new machine.

An analysis of individual machine repair costs will not only be of value in determining when a new machine is needed but will furnish an accurate basis upon which to select the proper type and make of new machines—a basis derived as a result of experience in your own shop. On many roads it is relatively less difficult to make an expenditure for overhauling an old machine than it is to secure the authority to purchase a new one, nevertheless the fact should not be obscured that in so doing the new machine is often actually paid for without profiting by the increased production that its purchase would make possible.

Freight car conditions never better

It has been understood quite generally that the condition of freight cars has been steadily improving for several years past and that the condition of this equipment at present is excellent. This general understanding is well attested by a number of facts. One of these is the growth in the proportion of steel and steel underframe cars to the total number of cars owned by the Class I railroads. The number of all types of freight cars in these two classifications has increased from about 52 per cent of the total ownership in 1915 to 74.5 in 1924, the last year for which the information is available. The proportion of steel and steel underframe box cars to the total number of cars of this type owned by the Class I railroads has in the same period increased from 38.6 to 64.5 per cent; while the percentage of coal cars in the same two groups has increased in the same period from 71.3 to 89.1. It is evident that the increase in the proportion of cars of steel or steel underframe construction is progressively improving the character of the equipment in interchange. It is probable that if the figures could be carried up to the middle of 1927, the

proportion of all types of cars in the steel and steel underframe groups would be close to 80 per cent.

That the present condition of equipment is good, however, is even more strongly indicated by Car Service Division figures for the percentage of cars awaiting repairs, particularly when this percentage is considered in connection with the number of cars reported as repaired in each half-monthly period. The trend in these figures for the half-monthly periods closing July 1, from 1923 to 1927 is illuminating. In 1923, 8.4 per cent of the cars on line were reported under or awaiting repairs, while a total of 1,293,000 were reported as having received repairs during the preceding half-monthly period, approximately 63,900 of which had received heavy repairs. In 1924, 8.5 per cent of the cars were reported as under or awaiting repairs, but only 974,000 cars had received repairs during the half monthly period, of which 36,123 had received heavy repairs. A year later there was no change in the percentage of cars under or awaiting repairs, but the total number of cars repaired during the half-monthly period ending with July 1 had again shown a reduction to 689,000, with a slight increase to approximately 39,000 cars receiving heavy repairs. In 1926 the percentage of cars under or awaiting repairs had come down to 7.2 per cent, with practically no change in the total number of cars repaired, but a reduction to about 35,000 cars which had received heavy repairs. In 1927, 16.2 per cent of the cars were reported as under or awaiting repairs, while the total number of cars repaired during the semi-monthly period ending with the first of July had come down to less than 667,000, of which but 33,000 had received heavy repairs.

With some seasonal variations, the figures reported as of July 1 are typical of the trend which has prevailed during the entire period under consideration. The reduction in the number of cars in or awaiting repairs in the face of a progressive reduction in the number of cars turned out during each reporting period is strong evidence of the marked improvement in the average freight car conditions.

Reducing the cost of machine tools

Recently, a mechanical department officer, who is responsible for the purchase of machine tools and shop equipment for his road, commented on the cost of high grade machine tools, for which the railroads to some degree are responsible. He went on to explain how the railroads could help machine tool builders to reduce the price of their products and still make a fair profit to which they are entitled. As a general rule, the railroads demand excessive service from the builder who sells the machine tool. When an order is placed for a machine tool nothing is said that the builder should "bell hop" the machine for an indefinite period. Some railroads seem to expect it, however.

A case in point is a planer, which, six months after it had been in service, failed to produce accurate work. The master mechanic wired the machine tool builder for advice as to how to correct the inaccuracy of the machine. The builder wired back that the machine should be properly levelled. This was done, but still the machine failed to give the desired results. Upon an urgent wire, the builder sent a service man to the shop which was located a little over 100 miles from the home office. Upon investigation, the service man found that an ordinary mason's level had been used to level up the machine. With the use of an accurate spirit level the machine was properly levelled and then produced accurate work. This instance cost the machine tool builder the traveling expenses covering 200 miles and the time of the service man. This extra cost to the builder could have been eliminated if ordinary sound judgment had been used in the first place when levelling up the machine.

This case was no worse than that of sending a service man to another shop to investigate a complaint about the pump on a new screw machine. When the service man arrived, he was told that the coolant did not flow steadily and splashed. He had the tank filled—that was all. The expense involved in sending a service man on such unnecessary trips must be charged against the output of the builder, with the result that the railroad in the end pays the bill.

Another factor that helps to increase the cost of machine tools is the wasteful utilization of the machine tool salesman's time when visiting railway mechanical officers. It is not unusual for a salesman to wait in an office for two or three hours in order to see a mechanical officer and often he spends his time waiting to see the wrong man. Salesmen usually work on a schedule. They must make a certain number of calls a day in order to cover their prospects. When they are delayed in this manner, their schedules are broken up, they miss their trains, and the cost of their calls increase and is finally charged to the product of the builder. Would it not be better if the mechanical officer made it a point to learn the supplyman's errand when he presents his card? Should it be that his business is not of interest to the railroad or that the party he wishes to see is absent, the salesman should be so advised at once and thus be at liberty to go elsewhere.

The railroads as purchasers of machine tools can help reduce their costs by properly utilizing—and not abusing—the service offered by the builders to the railroads. It should be remembered that the time of the sales force is valuable and that traveling expenses are high. By properly co-operating with the railway supplymen the railroads can help the service men and salesmen double their day's work and reduce sales costs proportionately.

An engineman speaks his mind

One of the features of the Convention of the International Fuel Association always is the discussion by the enginemen and firemen of the problems encountered in their daily routine. This discussion frequently develops information of the greatest practical value, indicating the keen and semi-humorous way in which enginemen analyze their problems and experiences. The following quotations from a talk by Cyrus E. Gallatin, Baltimore & Ohio locomotive engineman, while attending the last convention of the Fuel Association are typical.

"The amount of steam required to perform a certain amount of work, which is determined accurately by the volume of water used, determines the efficiency of the engine and the engineer. The amount of coal required to transform a certain amount of water into steam or energy, is determined by the skill of the fireman, the quality of coal consumed, the design of firebox and boiler, the proper draft, and the freedom of the heating parts of boiler from scale. It matters not how much water can be evaporated with a given quantity of coal, if any considerable amount of steam passes around piston or valve rings or is neutralized in needless back-pressure no good record can be made, and the engineer may run his engine at all times in the most economical manner with an engine that is nearly perfect and make a poor coal record if that part of the mechanism is at fault

which has to do with the steam before it passes through the throttle. * * * While a real good fireman may at times resemble a coal mine, he is not; he is a gold mine! And the company that lets good gold mine stock slip through its fingers is not wise, * * * It is an extravagance to make an engineer out of a real good fireman while there are so many [illegible] ones who might answer the same purpose!

"It takes very little more coal to maintain a speed of 60 than to maintain a speed of 40 miles an hour, that is, when that speed can be made without overworking the engine, but it takes an enormous amount of coal to get a train up to the sixty mile gait. Also, when making a schedule which requires an engine to be worked near capacity in making up additional time, it is done at the expense of a great deal of coal. All operating officials already know this, but they don't all know it very well or they wouldn't tolerate the unnecessary stops and slow downs that are too often made.

"With these fundamentals understood the question arises as to practical means of obtaining and maintaining the highest standards of operating efficiency. There is no use to go to Sunday school in the morning and then go fishing and fall in the water and get licked in the afternoon. We all know that there are firemen firing engines that should by all means be somewhere between heaven and earth, learning something, and that there are engines by the droves going up and down through the country making horses run off that should by all decency be in some junk yard. We all know, at least all of us who know anything, that the present means of determining just when an engine should be shopped, is at least several generations behind the times. Now if you gentlemen in authority insist upon chain ganging your engines and by so doing make orphans out of them, you should adopt a system whereby an engine will be shopped the day she becomes uneconomical to run."

More power to the enginemen and firemen! They should be encouraged in every way possible to take a personal interest in their work and study ways and means of securing better results. Railroad mechanical officers of all ranks can profit from the experience of the enginemen and firemen. The observations of many of these men possess a high degree of accuracy.

Apprentice training problems

Hayes Robbins' article on the new methods of apprentice training which were introduced on the Baltimore & Ohio and the Missouri Pacific last year, the second and concluding part of which will be found elsewhere in this issue, will, we hope, do much to stimulate constructive thinking on this problem which is so vital to the future welfare of the mechanical departments and simply will not be downed. Mr. Robbins appears not so much an advocate of the new methods as one who has tried to present a clear and fair picture of these developments. A careful reading of the article, for instance, will indicate that he has clearly sensed certain features that will quite likely be criticised and attacked. In doing this he has deliberately pointed out some of the objections that may be voiced, but at the same time has presented the viewpoint of the advocates of the new system.

As frankly stated in the last paragraph of Mr. Robbins' article, no one system will adequately meet the great variety of conditions that exist at different points and in various sections.

The new scheme, however, promises to challenge constructive thinking on a fundamental problem of the mechanical department, the vital importance of which is steadily becoming more and more generally recognized. We need a variety of experiments in apprentice training finally to determine the relative values of the different mthods and practices to meet specific conditions.

Fortunately there are in the mechanical departments today a number of progressive—some of them quite aggressive—men who are taking a keen interest in the possibilities of training employees, both new and old. Some of these men are breaking away from the beaten paths and are doing much original thinking and not a little experimenting. What is now needed more than anything else is a clearing house where they can get together and frankly compare experiences—failures as well as successes. Let us hope that the Mechanical Division of the American Railway Association will find some way of bringing this about. Incidentally, one of the younger men in this group, T. C. Gray, supervisor of apprentices of the Missouri-Kansas-Texas, will give the members of the New York Railway Club, at its September meeting, the benefit of some of the interesting and out-of-the ordinary experiments and developments in trades training on that system.

The past quarter of a century has witnessed a great change in attitude on the part of mechanical department officers, supervisors and workers toward apprentice training. In spite of all efforts to sidestep the problem and evade responsibility, it is becoming more and more recognized that the future of the railroads depends largely on the degree to which its personnel, from the bottom to the top, is carefully and intelligently selected and trained. No longer can apprenticeship be considered as an incidental matter which can be neglected and kicked about as a homeless, friendless cur, unless by accident it is taken in and fathered by some big-hearted, whole-souled chap. (Fortunately for American railroads there have been a number of such men whose names should be inscribed on a permanent roll of honor.) Carefully selected, well trained employees form the sure and substantial foundation upon which the mechanical department is dependent for its future position and success in the railroad organization.

The task is no easy one. It requires experts who understand the technique of teaching and training; more than that, it demands big men who are naturally endowed with teaching ability. Many people understand the technique of teaching—comparatively few are endowed with those qualities which are necessary for real and effective teaching. It is important that this distinction be fully recognized in selecting the personnel for the training work; a matter, by the way, which is not secondary to the preparation of the study courses and the material in them, or to the scheduling of the training work in the shop.

New Books

MANUAL OF ENDURANCE OF METALS UNDER REPEATED STRESS. *By H. F. Moore, research professor of engineering materials, in charge, investigation of fatigue of metals, University of Illinois. 5 in. by 7½ in., 63 pages, illustrated. Published by the Engineering Foundation, 29 West 39th street, N. Y.*

This book contains a brief summary of data and information relative to the fatigue of metals which have resulted from the joint investigation sponsored by the National Research Council, the University of Illinois and the Engineering Foundation. It also contains the results of investigations conducted by government bureaus and a number of industrial concerns. The author has also added considerable data scattered through numerous scientific and engineering publications.

High pressure steam locomotives

What type of power is best suited economically to utilize pressures of 800 lb. and over?—A discussion of the future locomotive

By James M. Taggart
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Part I—The boiler

IT is the general belief that higher steam pressures than any now used would add to the economy of locomotive operation. It is also generally conceded that for higher steam pressures there is at present no satisfactory type of locomotive boiler. There is considerable divergence of opinion as to what pressure would be most advantageous. Also there is an uncertainty as to just how much gain will result from any increase.

Late advances into moderately high pressure locomotives have produced various designs largely based on, or supplementary to, old types. All the designs that have been tried out are limited as to pressures attainable by the water barrel feature of the boiler though many of them have eliminated the flat surfaces and staybolts.

Formerly the author* advanced the suggestion that a complete water tube boiler, preferably of the flash or non-water line type, would be best suited for the extremely high pressures contemplated. For complete safety from explosion the non-water line type of boiler would be needed. The inclusion of an economizer, superheater and air preheater sections would, of course, be necessary for good economy.

Up to the present time increases in steam pressures have been accompanied by decreases in boiler efficiencies. This, of course, has been due to the higher steam temperatures and, therefore, the lower heat absorption. Stokers and better furnace design have reduced the losses that might be expected. On the other hand, greater combustion intensities have further decreased efficiencies for high loadings.

All the gain in economy that has been realized up to the present has been due mainly to the increased power availability of the steam. On account of the limited expansions that can be readily used in any design of locomotive cylinders as yet devised, the decrease in water rate has not been in proportion to the increase in power availability.

In the moderately high pressure locomotives now in use there has, therefore, been a moderate increase in overall economy. There has also been a considerable increase in capacity. Apparently there has also been some increase in reliability even though the design has been complicated.

In the proposed trial arrangement intended to illustrate the factors involved there should be a further decrease in water rate and an increase in capacity. In addition, there should be an increase in boiler efficiency and an added element of safety. The fuel assumed is coal, though oil-burning would fit in equally well.

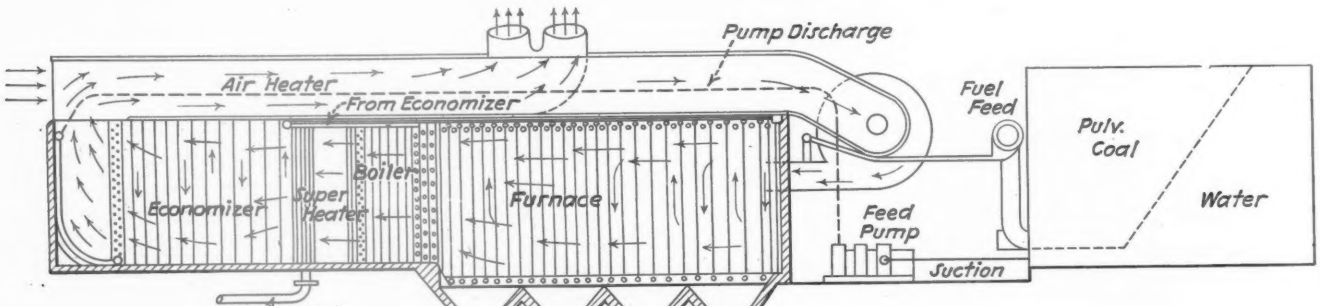


Fig. 1—Sketch of proposed locomotive boiler arrangement

Experiment with fuels

Pulverized coal burning is being tried out on a number of railroads. It has often been used to suit special conditions. John E. Muhlfled, consulting engineer, New York, in Vol. 38 of the A. S. M. E. transactions for 1916, describes a series of tests and periods of operation with pulverized fuel. He successfully burned a mixture of 60 per cent anthracite screenings and 40 per cent bituminous in a standard locomotive. The results apparently were increased economy and capacity. With the present type of locomotive and the pulverized fuel burning equipment then obtainable, the advantages were not sufficiently evident to warrant further adoption.

During the last six or seven years there has been a rapid development in the art of burning pulverized fuel, especially in power plant boiler furnaces. Equipment has been improved and experience linked up to theory.

It has been ascertained that with a turbulent form of burner, with fine pulverization and the air preheated, pulverized coal can be burned at higher furnace volume intensities than can be attained by any other method

*See page 10 of the January, 1927, *Railway Mechanical Engineer* for the author's discussion of the paper by Prof. E. C. Schmidt and the late Prof. J. M. Snodgrass, presented by the Railroad Division at the annual meeting of the American Society of Mechanical Engineers, December 7, 1926.

of coal burning. This applies, of course, to approximately complete combustion within the furnace.

For pulverized coal burning the fuel should be prepared at the loading bunkers. The cost of pulverization and drying should not be a serious factor. It often works out in power stations that the cost of pulverization and drying for pulverized fuel burning is more than equalized by the extra equipment and power required for stoker operation. This might be especially true for locomotives where each stoker has its added crusher and the blowing units are inefficient.

At the present time the intensity of combustion for the larger locomotives at maximum loading runs up to 220,000 B.t.u. per cu. ft. of furnace volume. It is quite probable that at the later figure a good deal of the combustion is not complete before reaching the stack. The efficiencies even in tests at these maximum [illegible] run only between 50 and 60 per cent.

Design of firebox

The limit of combustion intensity with pulverized fuel, as we know now, depends on a number of functions which are all controllable. The practicable limit as applied to boiler furnaces apparently is fixed by the endurance of the furnace walls, other conditions being suitable. It is even probable that intensities such as are noted for present locomotive practice, could be attained with approximately completed combustion.

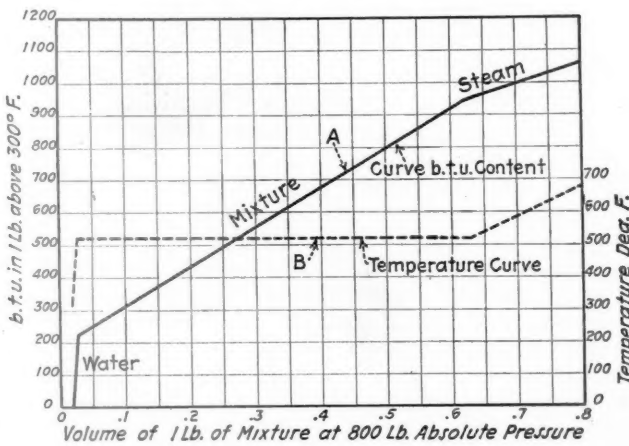


Fig. 2

It is known that with the proper conditions formerly noted and with a suitably designed furnace, intensities up to 100,000 B.t.u. per cu. ft. are feasible. Avoidance of violent flame impingement against furnace walls combined with a quick and thorough mixture of fuel and air are the main requirements. Just what fineness of pulverization is required for any specific intensity is not accurately known. This depends partly on the shape of the furnace and the form of burner.

With the locomotive, apparently the general shape of the furnace would need to be the same as at present. No grate, bridge wall or arch tubes would be needed while the bottom would be formed of some heat absorption surface or ash cooling surface.

It is not believed that it will be advisable to reduce the present horizontal area allowed for the combustion chamber or firebox. Removal of the grate and bridge wall as well as the contained fuel bed should, therefore, increase the volume. Since the economy with the arrangement proposed would be much higher than at present obtainable, therefore, the combustion intensities required for maximum loads should be well below 100,000 B.t.u. per cu. ft., or within the range where it is known fairly good results can be obtained.

Increasing the effective height of the furnace and adding surface to the bottom also increases materially the furnace or firebox heating surface. With relatively high combustion intensities and with most of the coal now burned by railroads, increase of the direct radiant heat absorbing boiler surface is now known to be a distinct advantage on the economic side.

Absorption of heat

It is customary to speak of boilers, superheaters, economizers and air preheaters as separate apparatus. In reality, they are interdependent and form a heat absorber. They should be proportioned and designed with a view to obtain the most economimcal heat absorption. Economical heat absorption includes consideration of first cost and maintenance as well as thermal effect. Of recent years numerous old theories of heat absorption have been proved or disproved so that at present effects can be computed closely for known conditions. Variance in certain conditions, such as character of fuel, cleanliness of surfaces, and eccentricities of control constitute the chief uncertainty in results.

The amount of radiant heat absorption surface will evidently be limited by the volume of the furnace. It should be made normally as great as possible, or, in other words, all furnace surfaces should be made fully effective for radiant heat absorption.

To determine the remaining boiler surface required, it is necessary to compute the amount of additional surface required for changing the feedwater to steam. Beyond this point should extend the economizer. This follows since economizer absorption efficiency will be greater with proper design and the space occupied will normally be less.

The air heater should receive the gases at the point where the heat flow for an economizer does not much exceed what could be attained in the first sections of the air preheater. By using a plate preheater 10 to 12 sq. ft. of heating surface per cu. ft. can be obtained. This is more surface per cu. ft. than would be feasible for an economizer. There would be no contained pressures and the cost per sq. ft. would be much lower for the same heat transfer for the temperature ranges down from the economizer.

It is quite probable that it may be impossible to find a suitable arrangement for a counter-flow air heater. The arrangement shown in the sketch, Fig. 1, has a parallel flow air preheater. Parallel flow has some advantages on the side of maintenance though the heat transfer per sq. ft. would be less than for counter flow. This follows since the principal maintenance required is due to corrosion and soot adherence, which occurs when the temperature of the gas falls below dew point. In a counter flow heater this condition is often found at low loads, while in a parallel flow heater it seldom occurs at any load.

With the high pressures proposed some form of series or regenerative feedwater heating would be advisable. With this in view the feedwater has been considered as heated to approximately 312 deg. F. Any arrangement installed would give a varying final temperature. Just what final feedwater temperature would be most advantageous would depend largely on the form of drive and the type and number of heaters selected.

A tentative proportioning of heat absorbing surfaces is given in Table I. The proportioning is based on an assumed size of firebox, steam pressure, feedwater temperature and coal.

The firebox size is taken approximately as for pres-

ent practice with the grates and bridge wall removed. The radiant heating furnace is considered as the amount of cooled surface exposed with an extra allowance for the top and back tubing.

The relation between the heat absorption by boiler surfaces exposed to the fire and the total heat liberated in a furnace are fairly well known. There is some dis-

Table I—Surface proportions and estimated effects

	Surface		Heat absorption			Temperatures		
						Of gases, deg. F.		
	Proportion of total, per cent	Amount, sq. ft.	Total, million B.t.u.	Average per sq. ft. thousand B.t.u.	Per cent of total	Inlet	Outlet	Average
Furnace walls	7.05	702	29.5	42.	52.7	....	....	....
Boiler	7.03	700	8.4	12.	15.	2,200	1,750	1,975
Superheater	8.92	866	6.2	7.	11.1	1,750	1,420	1,585
Economizer	33.8	3,370	11.8	3.5	21.2	1,420	790	1,105
Total	....	5,658	55.9	...	100.0	....	....	....
Air heater	43.2	4,300	6.	1.4	....	790	470	630
Total	100.0	9,958	61.9	...	....	....	....	....

Steam pressure taken as 800 lb. absolute per sq. in.
Steam temperature taken as 700 deg. F.
Feedwater temperature taken as 312 deg. F.
Water per hour, maximum, 51,277.
Coal per hour, maximum, 4,850 lb.
Gas per pound of coal, 15.5 lb.
Temperature of atmosphere, 70 deg. F.
Firebox volume, 800 cu. ft. approx.
Combustion intensity, 80,600 B.t.u. approx. max.

agreement relative to reasons and causes. Tests show, however, a close agreement as to results where the fire and furnace conditions are similar. Thus with high CO_2 and air preheated, there is a much higher proportion of radiant heat absorption by exposed surface than with low CO_2 and cool draft. The value given in Table I is conservative for the CO_2 and fine pulverization proposed. Thus the ratio or value of μ (relative radiance)* as it is commonly called, is taken as about .47.

Functions of the superheater, boiler and economizer

The remaining heat required to change the water to steam is considered as generated in the convection area of the boiler. The surface required is found based on an initial temperature of gases, assumed from a computed flame temperature and coefficient based on numerous tests for similar conditions.

The superheater surface is considered as placed between the boiler and economizer surface. In Table I the boiler surface as shown refers only to steam generating surface not exposed to the fire. Thus its amount will be relatively small and the gas temperature into the superheater will be high.

The economizer surface proposed includes all the surface needed for heating the feedwater up to the steam temperature. Thus with unbalanced conditions and load variations there will be at times some steam formation in the economizer and at other times heating up of the feedwater will be continued in the boiler sections. In effect the superheater, boiler and economizer would all form parts of one absorber and their functions would over and interlap.

The air heater, though it forms an extension of the heat absorbing cycle, only affects the furnace efficiency. Thus all the heat absorbed therein is returned to the furnace. As before noted, its size should be relative to the economizer. All heat absorbed by the surface exposed to the flame is spoken of as radiant effect, while heat absorbed from the gases is referred to as heat transference by convection. Neither is true since there will be some heat transference by convection in the furnace and, on the other hand, the gases will give off considerable radiant heat. This latter is especially true where the gases are at a high temperature which, in the boiler outlined below, will comprise about all of the surface rated as boiler and superheater surface. In the economizer the radiant effect will reduce in proportion, but will still be considerable.

As the convection heat effect increases in proportion, the velocity flow of the gases and their turbulence of flow should be increased.

It will be noted in Table II that the efficiency is given as 83.4 per cent. This figure for the arrangement proposed and the surface provided is conservative and should be easily realized with good design and con-

Table II—Heat balance estimated

	Million B.t.u.	Per cent
Heat in coal	65.468	100
Heat in combustible in refuse	.654	1
Heat required to evaporate moisture	.981	1.5
Heat liberated in furnace	63.833	97.5
Heat absorbed, except for air preheater	55.910	85.4
Heat loss by radiation	1.309	2
Heat lost out the stack	7.920	12.1
Heat given to water and steam	54.510	83.4

struction. The boiler efficiency should increase up to 90 per cent as the load drops. It is a characteristic of the arrangement proposed that for all average loads the efficiency curve is very flat. The steam pressure and temperature assumed are not extreme. The construction proposed would fit any pressure. With higher temperatures special steels would be advisable for the superheater, steam piping and a portion of the boiler surface. It is possible that it may be advisable in all cases to use high temperature steel for surfaces exposed to the fire.

All that has been said descriptive of the boiler, etc., can refer to any water tube type of boiler. For locomotives, as has been suggested formerly a flash type or a non-water line boiler would be preferable provided its operation can be depended on. It has often been stated that the present form of locomotive boiler cannot be replaced by a water tube boiler since large heat storage is necessary. This same argument has been advanced against the use of water tube boilers for various industries. In most cases it has proved that the quicker steaming possible with the smaller contained water was as much an advantage as the smaller heat storage was a disadvantage. This has proved especially true for boilers with oil, gas or pulverized fuel. Thus with automatic combustion control and pulverized coal burning, especially where the pulverized fuel is obtained from storage, the control of the steaming within wide ranges can be made almost instantaneous. With the non-water line boiler, this feature is even more pronounced since the water content is smaller and the heat effect is progressive. Thus there could be no injection of cool feedwater into the steam to hold down the steaming and the radiant heat effect, which is the first part to respond to a change in combustion, is all concentrated on the steaming section of the boiler.

Automatic combustion control has been successfully carried out for stationary power plants. The principles are now fairly well understood. The regulations as applied to a pulverized fuel system that introduces all the secondary air through one duct are simple. Much of the apparatus on the market is fragile, complicated and unsuited for use on a locomotive. There is, however, no reason why reliable rugged automatic combustion control cannot be applied to a locomotive furnace using pulverized fuel.

Flash type boiler

There have been many attempts to put a non-water line type of boiler on the market. Some of the at-

*See papers by W. J. Wohlenberg and D. C. Morrow and B. N. Brodio in the A. S. M. E. Transactions for 1925.

tempts ended in failure. Notable of these is the Belleville boiler which was later changed to a water-line boiler. Some have had, for small sizes, a fair amount of success. Among these are various steam automobile boilers and the Talbot boiler. The latter was used on small boats to a limited extent. The performance of these boilers, as tested and proved by operation, are illuminating. None of them, it is believed, are suitable for the conditions here considered. Practically all were on the counter flow principle, thus exposing the superheater surface to the furnace radiation. Also in all cases the area of flow through the economizer, boiler and superheater surfaces was constant. This results in excessive flow velocities through the superheater and parts of the boiler.

The principle of counter flow is important for economizer sections. It is not important for the boiler sections. With the superheater direct exposure is dangerous, and a shrouded type would materially lower the total radiant heat absorption.

In Fig. 1 is shown an outline of the general arrangement proposed. It will be noted that counter flow is proposed for the economizer sections and that thence the flow goes through the tubular furnace walls, then to the boiler tubes next to the fire, thence to the remaining convection surfaces of the boiler and finally through the convection superheater.

With the non-water line boiler, the feed pump and flow control become essential parts of the boiler. No arrangement could be tolerated that allowed any probability of failure of supply. However, almost the same condition holds for certain types of water tube, water line boilers running at high ratings. Emergency control probably would be advisable for shutting off the fire in case of any abnormal breakdown. The equipment, however, should be of such character that only an abnormal failure could take place.

In non-water line boilers, two methods of automatic feedwater control have been used. Automobile boilers have regulated the flow by the steam pressure and the Talbot boiler used temperature control. For the larger size boiler here considered and also for the better protection of the engines, temperature control is considered best. It is entirely possible to build an automatic temperature control for feedwater that will be reliable and positive from valve closure to a full open valve.

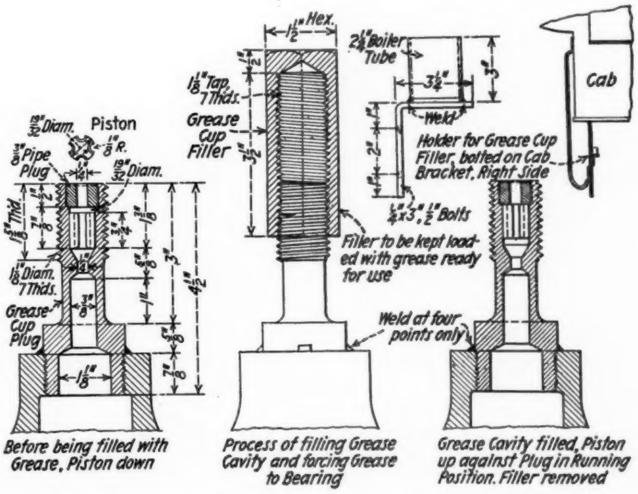
In Curve *A*, Fig. 2, are shown the relative volumns of the water and steam from the feed to the outlet of the heat absorber relative to their heat absorption. In the economizer the volume is small and nearly constant. As steam formation progresses, the volume increases rapidly. Where superheating occurs, there is a steady and more rapid increase in volume. Different velocities will be desirable for the water, the mixture and vapor. The area of flow should thus be proportioned to give the velocities best suited, considering pressure drop, heat absorption, and maintenance of mixture for all loads.

Of course, the heat transfer will vary with the velocity of flow, or to be exact, with the turbulence of flow. Since it is not permissible to use other than even section tubes in a boiler, only the velocity of flow and area of flow will effect the turbulence and thus the heat transfer as far as the fluid side is concerned. Numerous tests have been made to determine just what heat transfer we might expect for different velocities. Also there are records of operation with various types of boilers, superheaters and economizers. From this data the velocities of flow required to insure the desired heat absorption can be selected. This selection will always be a compromise. Thus the velocity for an emergency maximum flow must not require an excessive pressure drop. Minimum flow velocities should be sufficient to prevent a separation of water and steam in the boiler. This will involve design that will insure evenly distributed flow through the tubes and remixing in the headers. Since with the use of a differential pressure pump governor, the pump must always work against the boiler pressure plus the maximum pressure drop through the boiler, it is desirable to use a regulator that will vary the total pressure drop in approximate ratio with the load.

It is probable that with clean feedwater and good design, boilers such as are suggested would require less maintenance than present types. The first cost it is estimated might be lower than for the present designs. These estimates are based on the consideration that the boiler, superheater and economizer would be composed of standard tubes and uniform forged headers of moderate strength. Also the air heater would be built up from standard light weight plates. Thus parts could be easily cleaned or replaced. The whole thus would be simplified, though the number of parts would be increased. (The second part of the article, which will appear in the October issue, will discuss the various types of drives and auxiliaries suited to utilize economically steam pressures of 800 lb. and over.—EDITOR.)

Grease cup filling device

THE grease cup filling device shown in the drawing is used on a number of locomotives on the Louisville & Nashville. Grease formed in sticks is used with this device. Grease is placed in the grease cup filler which is 4 in. long by 1½ in. wide and is hexagon shaped to permit turning with a wrench. The grease cup filler is tapped to screw on the grease cup as shown. The upper end of the grease cup is fitted with a ⅜-in. pipe plug which has a ¼-in. hole drilled through the center.



Detail construction of the grease cup filling device

Directly under this plug is a piston, an end view of which is shown above the cross section of the grease cup at the left.

Grease is forced through the ¼-in. hole in the plug and through the four grooves on the side of the piston to the grease cavity as the grease cup filler is screwed down on the cup. When the grease cavity is filled the piston is forced up, as shown in the cross section of the grease cup at the right, which closes a ¼-in. hole.

Provision is made for carrying the grease cup filler in a cup made of 2¼-in. boiler tube which is welded or bolted to the cab-bracket.

A new undertaking in apprentice training

Part II—Its effect upon the supervision and how the boys feel toward it

By Hayes Robbins

Formerly Assistant to the President of the Boston & Maine. Author of "Human Relations in Railroading"

PART 1 of this article, published in the August number of the *Railway Mechanical Engineer*, page 541, told in some detail of the methods used in the new type of apprentice instruction on the Baltimore & Ohio and the Missouri Pacific.

Talks with apprentices

How much of "human interest" it is possible to inject into a plan of this type is a question not to be fully answered as yet. Impressions of only limited value can be gained from the comments of the handful of boys it is possible to see on a brief investigation, but these impressions have a certain significance nevertheless, as far as they go. I was able to interview, on the two roads, 18 apprentices, picked at random while going through certain shops, without advance notice. Except in one case, no supervisor or official was present during these talks of from ten minutes to half an hour each. All the boys had gone through most or all of the common school grades, some had had high school experience, two or three had pursued or were still pursuing evening class work in schools for technical or trade training.

The direct question was put, whether they believed they could get as much out of their studies under this method as they would from regular class instruction. Three believed they would do better in class; these were boys who had been out of school for some years and had gone to work before high school age. Two or three were non-committal. The others expressed preference for the present method, and of these the majority gave as a principal reason that it put a boy upon his own responsibility to "dig it out." Other reasons volunteered were that a boy could ask questions in his paper or of the instructor on his calls but would not speak up in class. On the question whether the corrections and explanations noted on the returned lessons were clear and sufficient, it was apparent that much depends on the nature of the problem. The answer was affirmative from perhaps two-thirds of the boys; the others, on the more difficult work at least, found additional help from the instructor necessary. At one point at least, possibly at others, a group of boys have gone still farther and arranged temporarily for outside help in mathematics by a local school teacher, one or two evenings a week.

Other help available

At the large Mount Clare shops, Baltimore, where between 250 and 300 apprentices are employed, the district instructor is within reach during rather more than two-thirds of the month. Here, as at certain other shops on both roads, the local shop instructor whose duty it is to assign apprentices to their work schedules and give floor instruction is available at practically any time to assist boys who come to him with questions on their studies. At Mount Clare this official was himself an apprentice instructor under a former plan. These shop instructors are a part of the regular shop organization and not of the new training plan as such, but they have the important job ahead of co-ordinating so far as practicable the floor instruction on machines and operations with the studies the boys are pursuing.

At several points on both roads the boys are at liberty to use certain rooms at the shops for study after working hours or for meeting instructors. At one important point on the Missouri Pacific, arrangements were under way to assign certain supervisors of special qualification, in rotation, to spend an hour perhaps twice a week after the 3:30 closing in attendance at the designated room to help any boys who might come there for questions or study.

At North Little Rock shop the apprentices have formed a club, holding weekly meetings, at which any question in the training course may be put and discussed; if it is not answered satisfactorily note is made to bring it up at the next meeting attended by the traveling instructor. The boys here have appointed a committee to investigate delinquents among their own number and impress upon them the importance of maintaining the schedule, as well as to give assistance when necessary. They have invited the local supervisors to attend, and thus far have had a talk from some supervisor at each meeting. Some indications of team rivalry crop out in a development of this sort. It was in evidence at another point where the 18 apprentices employed had a 100 per cent record of papers turned in on or ahead of schedule. One of the boys here, with whom I talked, remarked that they "didn't propose to let the bunch at ——— get ahead of them."

The boys at North Little Rock have included social features, assessing themselves 25 cents per member as monthly dues for the purpose. At Osawatomie, Kansas, about half the members of the railroad "Boosters" baseball club are apprentices. At Mount Clare, Baltimore, many of the apprentices are already members of the local relief association which has its social activities, and some are members of the shop band. But the club idea for apprentices only is apparently making headway, especially at smaller points where counter attractions are less numerous.

Reaction on the supervision

One of the hoped-for results of the plan in the minds of its projectors was and is to turn the boys towards their own supervisors for help in their studies as well as their work, at least in the intervals between visits of the traveling instructors. Inquiry of the apprentices interviewed indicates that actual help from this direction, for some time to come, will be limited to occasional cases of individual aptitude and interest, of which it is true there are some encouraging instances. One of the

reports from a traveling instructor, for illustration, quotes an apprentice at a Colorado point as saying that "he had never had a foreman take a personal interest in him," but that since he had embarked on his present studies "his foreman had visited him at his home several times to go over questions that bothered him in his lessons." The foreman in question, being interviewed in turn, expressed the idea that the work "made a foreman get acquainted with the boys, and that incidentally he was getting as much help out of helping the boys as he was giving."

But as a general rule, thus far, it appears as might be expected that the average foreman is "too busy" with the production drive during shop hours, and is not likely to be available for help after hours, except by special arrangement. Furthermore, a considerable proportion of the foremen have themselves had no opportunity for technical training beyond what could be picked up in their own shop experience, and here an interesting by-product of the present plan is already making itself felt, in spots. There are instances on both roads of mechanics and supervisors who have taken up for themselves the studies required of the boys.

One machinist, for instance, who began his own studies in the fourth month of the new plan writes that he was led to do this "by the comments of apprentices at the shop who are being schooled." In other instances the inciting motive rather obviously has been the difficulty of answering questions raised by the boys. What is in evidence here, although too meagre for safe predictions, accords with the outcome of an experiment with which I was closely familiar on another road. A class for foremen and one in more elementary work for mechanics had been started at the same time, but it was promptly found necessary to cover the same ground with both.

It will be well worth while to watch the extent and results of this pressure from a large body of "mechanics-to-be" upon men already higher up in the ranks. What reinforcement may it give to the argument for systematic foreman training, as well as for greater attention by managements to the opportunities for technical study by adult mechanics? Foreman training, indeed, covers a range of problems peculiar to itself, in advanced shop practice and the successful handling of men, but until all our mechanical forces are built up from the ranks of those who have had the groundwork of technical training such as is now available to apprentices on a number of roads there will be a serious break in the continuity of our provision for fully efficient supervision.

The attitude of supervisory forces on the job, so far as opportunity was found to discuss the subject, was strongly favorable to the working of the plan thus far. At one point I was taken through the shop by a foreman who had been particularly skeptical of the early arguments advanced for the experiment, but who gave me reasons of his own for expecting of it a material improvement in quality, both of the apprentice forces and of their shop work. It is safe to assume nevertheless that it will be more or less unwelcome to the foreman of the type who dislikes to be troubled with questions from boys or who may imagine his own job menaced by too much improvement in capacity and knowledge farther down the line.

In the approval voiced by several of the supervisors interviewed, a rather interesting and human aspect was the fact, as they put it, that the dropping of delinquents from the service through a method uniform for all automatically weeds out most of the boys who have not the "makings" of good mechanics, those they would like to dispense with anyway for the good of the service, and in so doing relieves them materially from suspicion of favoritism or prejudice or from the "influence" of relatives and friends.

The monthly test, and examination of applicants

It is freely acknowledged by officials on both roads that the plan is likely to require adaptation to conditions, as experience may suggest; in fact, some stress is laid upon its "elasticity." Some changes, and particularly additions to the early practice, have already been made. Development of the club feature, now getting under way, is one such. A monthly test or quiz and general discussion for all the boys at a given point (taken in sections at the larger points) is being given by the traveling instructors. The object in part is to check up on those who may be copying the work of others, and in part to establish personal contact not alone with the boys needing special help, who are seen on the semi-monthly rounds, but with the larger number who are making the grade, so far as the records show, but are no less entitled to attention and encouragement.

The "quiz" in these instances is oral, intended to last from one to two hours, but in the latest instance related to me on the Missouri Pacific the boys had kept the instructor until nearly midnight with discussion on the test questions he had used. These questions he prepares in advance with special reference to current work of the apprentices at the given point. On the Baltimore & Ohio the oral test has been used for the same purpose, when and as the instructor believed it desirable for certain boys, and is now being made a regular monthly routine.

How to make sure of honest individual effort, without cribbing, is a problem met in some measure under any and every educational system from the first year in the common schools to the last year in college. Where mail lessons arrive at about the same time, copying is comparatively easy to detect in the case of sketching and drawing and of questions requiring answers in the boy's own language; it is more difficult to trace in the case of mathematical problems where one boy can borrow the corrected lessons of another farther along in his work. How much of this is actually going on in the present instance it is difficult to estimate. At one and the same point some boys have told me that a large amount of cribbing is done, while others have been equally positive that it is limited to those who "won't work anyway."

At two points there were boys who remarked that the oral tests applied by the instructors had uncovered some of this evasion and that the effect had not been lost upon others. Supplementing these tests a periodic written examination in mathematics went into effect in June on both roads and the corrected papers are returned, not to the apprentice, but to the chief mechanical officer. It is a test at long range, although not different in that respect from such a system as the New York State Department of Education has employed for many years in the periodical written examinations in high schools, conducted by the University from Albany.

The borrowing of corrected papers was made easier at first probably by the privilege afforded to those who get ahead of schedule to suspend work until the routine is overtaken. The present view is adverse to this practice, not so much however because of the opportunities it affords to cribbers as of the unsatisfactory results to the boy himself of a spasmodic study program. The rule is under consideration that an apprentice must come up to a certain standard on his grades before being al-

lowed to go ahead of schedule, and maintain two lessons a month in any event.

It is true, of course, that new boys entering the service can have access to the corrected papers of those who may have kept them and are disposed to lend, but the entrance examination now given on the Baltimore & Ohio, and that just going into effect on the Missouri Pacific, are of a character to admit only boys already well qualified to go on with the apprenticeship studies.

The examinations specifically ask if these requirements are understood, including the possibility of elimination from the service if the schedules are not maintained. They embody a promise to make honest effort to assimilate the training and keep up-to-date. They contain examples in arithmetic, some of them in railroad terms, recite the applicant's personal and family history, including his school experience, name the trade he desires and his previous service, if any. A letter must be filed, from the school attended, certifying to the grades completed.

Attitude of the boys

It would be natural to expect that a large proportion of boys already in service would not voluntarily embark upon such a course of study. The ranks of the voluntary self-educators, even of collegiate grade, are seldom overcrowded anywhere, for that matter. The question was put to all the apprentices seen, with varying results. Most of the boys at the smaller points believed that the majority would now elect to go on with the work, whether compulsory or not. At large city points it was the prevailing idea that only an ambitious minority would undertake it, if left to their own choice. Of the boys actually interviewed, however, perhaps two-thirds answered without hesitation that if they had the choice of several jobs, only one of which provided technical training, they would take that job, even with the dismissal rule for failure to maintain schedule.

It would be quite too optimistic to infer that this is the view of most of the apprentices; it would be surprising if one-third of a force employed without anticipation of a study program were to make such a reply. Very probably many boys who have left school to go to work have done so in part to escape further study. The significant thing is, nevertheless, that on both roads there is today a long waiting list of boys who have applied for apprenticeship jobs, knowing what is required, and that a large majority of the recent applicants are boys with high school experience, many of them graduates. If this situation is maintained it gives us an interesting forecast of what the selective influence of training opportunities promises to be, in drawing a distinctly higher type of young men into the mechanical departments of the railroads.

Conversation with the boys led into a broader question. To what extent does the average apprentice realize that with the growth of technical education generally the time is approaching both in industries and railroads when substantially all skilled employees will be men who have had systematic training, a large proportion within the industry itself, and that boys not so equipped will more and more find themselves "out of it," obliged to take laborers' jobs or find other unskilled occupations?

It was the majority opinion that few of the boys ever gave the matter serious thought. Presumably, under any plan of apprentice training, there is a larger percentage of forethought and interest after the work has been in progress long enough for at least one cycle of apprentices to pass through the four-year period, so that all apprentices in service are boys who knew of the study obligation in advance. When this plan went into effect the importance of training to the boy as well as to the company was pointed out in talks and circulars, and on the Baltimore & Ohio particularly it has had attention in the company's magazine. But, it was believed, not many boys think much beyond the day or the week. This rather pessimistic view, again, was more in evidence in the cities than at the smaller shops. But it suggests the desirability of more thorough "publicity" with the boys themselves, for making clear the conditions ahead and the opportunity afforded.

The compulsory requirement

The compulsory feature will of course raise doubts in many minds. Is it fair to remove boys from service who do not care to study, or who may lack the mental capacity? Is it just to require them to study on their own time? Is there any practical value in education forced upon boys whose own ambitions do not bring them to it voluntarily? The reaction of organized labor to these questions also comes in for question.

In reply the contention is made that a management is under no obligation to retain boys who show no willingness to qualify for more efficient service; that ample assistance is offered to backward boys; that an educational requirement by a corporation is not different in principle from that which the community imposes in the common schools, irrespective of the ambitions or mental capacities of the students. It is rather interesting in this connection that, as a matter of fact, in several of the colonies in early days employers were required by law to train up to a useful trade any apprentices they might indenture, and were themselves subject to penalties for neglect of this obligation.

So far as concerns the attitude of labor, on the two roads in question the new training plan was put into effect with the endorsement and cooperation of the organizations with which, respectively, agreements are held. The rules governing apprentices, in the agreements, have been amended by mutual consent to provide for the new training requirements, including the elimination feature under stated conditions. The probable attitude of organizations on other roads remains to be seen, if and as the question arises.

Is it a "50-50" proposition?

It would be interesting to know how the boys themselves regard the question of fairness in having to study on their own time. So far as I could gather from conversation with the 18 apprentices referred to, there are two elements among those who object to the new requirements; one, the boys who do not want to study at all; the other, and presumably larger, those who would be quite willing to attend a class on company time, without definite requirement to maintain a specified schedule in order to remain in the service. One boy suggested that some of the fellows would rather sit in a class and be paid for it than work on their jobs!

General conclusions are not warranted upon the opinions and ideas of so few witnesses, though picked at random, except perhaps as reinforced by other experience and knowledge of human nature. Much depends of course upon whether the boys look upon the technical training as an opportunity, for themselves, or simply as something wholly in the interest of the company. Those to whom the question was put directly, whether it seemed a fair 50-50 proposition that the company put up the expense of the lessons and instruction, against the boy's time and effort, both deriving a benefit in the long run, replied in every case in the affirmative. This might be called a "leading question," it is true, with only

one answer reasonably possible, but it is after all the point to which the issue comes down. Advocates of the experiment look to this point of view to win its way, especially as those who may be unwilling students complete their time or drop out and are replaced by new boys. They describe it as a step away from paternalism, a method based rather upon the cooperative idea. Beyond doubt, it furnishes plenty of material for discussion and gains in interest accordingly.

A contribution to renewed interest

The arguments pro and con are by no means closed. The attempt on the Baltimore & Ohio and the Missouri Pacific strikes in a new direction in method, although not in ultimate purpose. It is fortunate in having unqualified official support on both roads, and in each case a mechanical officer in direct supervision whose practical experience and initiative are rather peculiarly fitted to the human requirements of such an undertaking The importance of these two prime essentials of success in any personnel undertaking can hardly be overestimated.

No one type of apprentice training is likely to monopolize all the desirable features, but there is something to be gained in having experiment under way and unlike methods on trial. The plan here described will quite probably undergo further changes in scope and detail. It is at any rate a contribution to renewed interest in the problem of enlisting and training in railroad service a high type of young man, with an eye upon not only today's job but upon what lies beyond. As such it is entitled to a fair statement of the claims made for it and of its working thus far.

Three-cylinder 0-8-0 type switchers

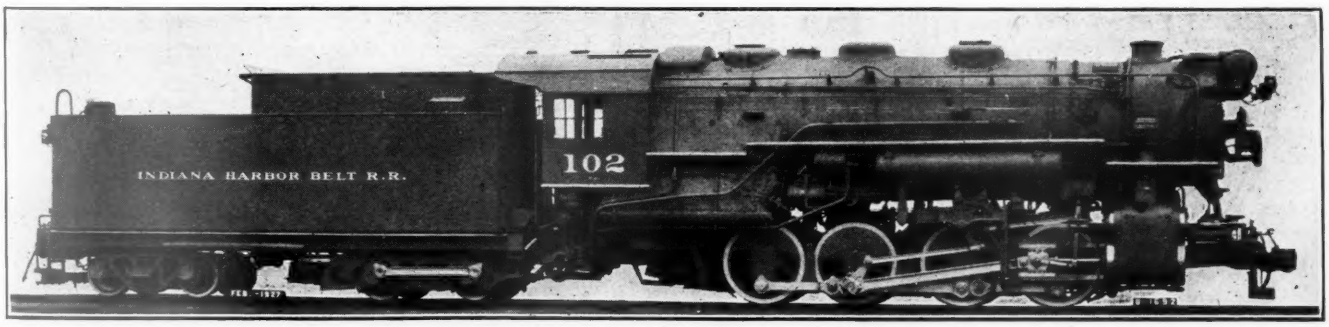
Indiana Harbor Belt buys three for hump and transfer service—Tractive force with booster, 89,500 lb.—Boiler of large capacity

The American Locomotive Company recently delivered three eight-wheel switch engines of the three-cylinder type to the Indiana Harbor Belt for use in hump yard and transfer service. These locomotives have now been in slow speed, heavy freight service at Gibson, Ind., for a period of five months, and had made 9,000 miles each up to July 1. During that time they have demonstrated their economy from an operating standpoint, as well as their practical freedom from mechanical defects. Depending somewhat upon traffic conditions, they are being triple crewed and used in 24-hr. service, with a short layover once a week for minor conditioning at the engine terminal. The three locomotives have not shown a marked improvement, however, either in water evaporated per pound of coal or in fuel consumption, over the two-cylinder, eight-wheel switchers formerly used on this work because the latter are also comparatively modern locomotives equipped with superheaters and feedwater heaters. The large economy in operation effected by the new power is due to its greater hauling capacity, making it unnecessary to doublehead or split the long trains of coal, steel, oil, or perishable merchandise which have to be handled over the 2.2 per cent grade at the crest of the hump at Gibson yard. In the winter time the longest train which the yard will hold can be handled over the hump without preliminary splitting and running back and forth to warm up the journals.

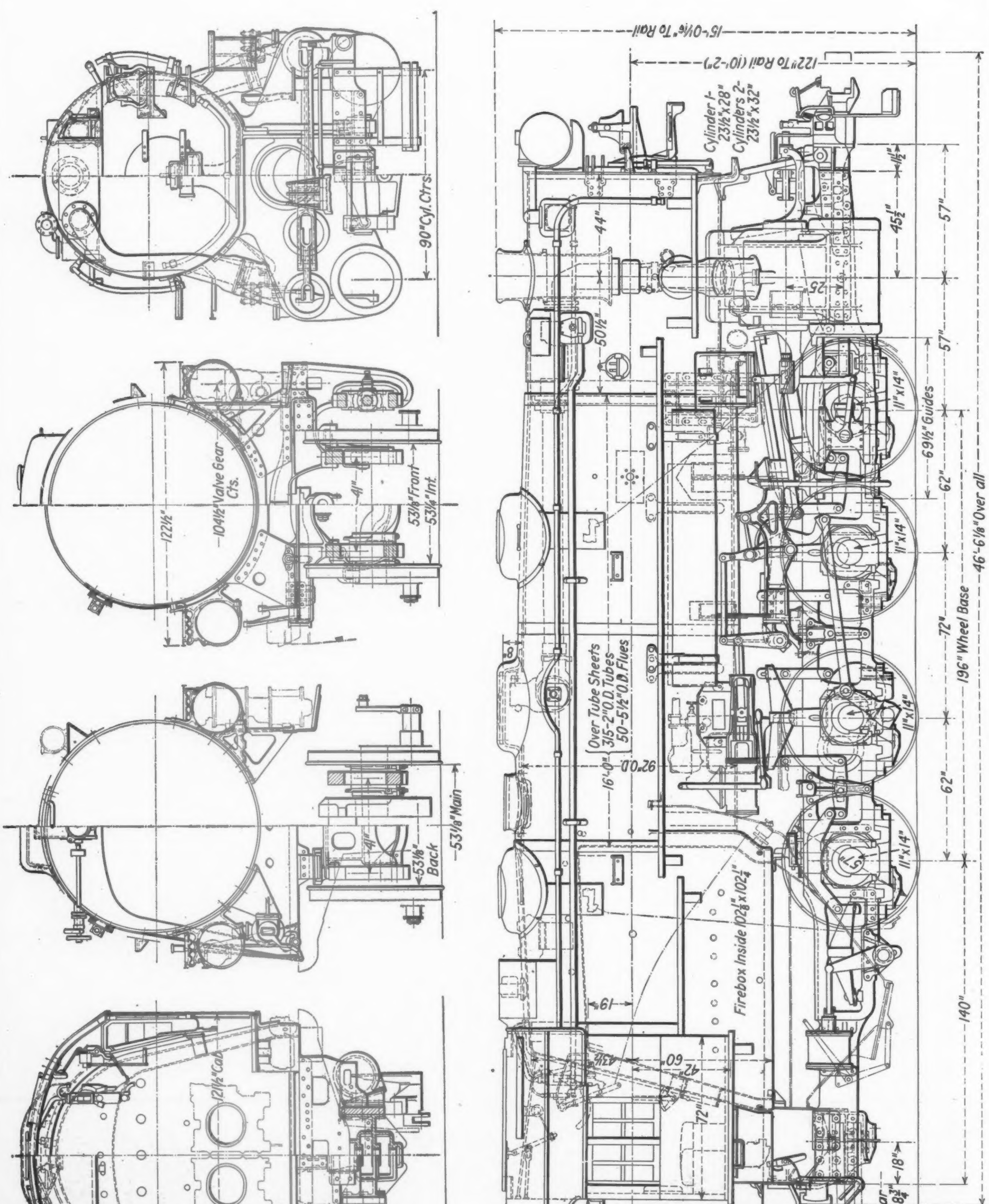
Comparison of Indiana Harbor Belt two- and three-cylinder 0-8-0 type locomotives

	Two-cylinder	Three-cylinder
Cylinders, diameter and stroke	25 in. by 28 in.	1—23½ in. by 28 in. 2—23½ in. by 32 in.
Tractive force:		
Engine	51,200 lb.	75,700 lb.
Booster	......	13,800 lb.
Total	51,200 lb.	89,500 lb.
Drivers, diameter	51 in.	57 in.
Boiler pressure	175 lb.	200 lb.
Weight on drivers	224,000 lb.	294,000 lb.
Evaporative heating surface	2,777 sq. ft.	4,017 sq. ft.
Superheater heating surface	610 sq. ft.	953 sq. ft.
Grate area	47 sq. ft.	72.5 sq. ft.

The table presents a comparison of the principal dimensions of the new three-cylinder engines and the two-cylinder, eight-wheel switch engines with which they are compared in the above paragraph. With an increase in weight on drivers from 224,000 to 294,000 lb., the new locomotives have a tractive force of 75,700 lb., whereas that of the former locomotives was 51,200 lb., and the diameter of the drivers on the new locomotives is 6 in. greater. In addition to the engine tractive force, the tender booster supplies 13,800 lb.,



Three-cylinder eight-wheel switch engine with tender booster, in hump yard service on the Indiana Harbor Belt



Cross-section and elevation view of the Indiana Harbor Belt Switcher

which makes a total available starting tractive force of 89,500 lb.

It will also be seen that the boilers of the three-cylinder locomotives are of much larger capacity than those of the older two-cylinder locomotives. They carry a working pressure of 200 lb. They have a total evaporative heating surface of 4,017 sq. ft. and are equipped with a Type A superheater with 953 sq. ft. of superheating surface. The grate area of 72.5 sq. ft. is unusually large for a switching locomotive. The locomotives are also equipped with Elesco feedwater heaters and American type front end throttles which are built into the superheater headers. Another noteworthy feature is the use of two fire doors, which are of the

Front end of the Indiana Harbor Belt eight-wheel switch engine

Franklin vertical type. The fireboxes are fitted with Commonwealth cast steel ash pans.

Cylinder design

The three cylinders are of the customary American Locomotive Company design; they are of cast steel and are fitted with Hunt-Spiller gun iron bushings. Steam distribution is controlled by two Baker long-travel valve gears, the center valve being actuated by the builder's Gresley type combining motion in front of the cylinders. The reverse gear is of the Ragonnet type. The inside cylinders are inclined to permit the main rod, which drives on the second coupled axle, to clear the first coupled axle, while the two outside cylinders drive on the third pair of wheels. The outside cylinders have a stroke of 32 in., while that of the center cylinder is 28 in., to obtain proper truck clearance for the back end of the inside main rod, because of the small wheel diameter. The driving boxes on this pair of wheels are of the builder's supplementary bearing type. All driving boxes are carried between bronze shoes and Franklin adjustable wedges. The locomotives are equipped with Nathan mechanical lubricators and Hoofer flange oilers.

The tenders are built up on Commonwealth steel frames and have Acme water bottom tanks with a capacity of 12,000 gallons. The coal capacity is 15 tons. Under the front end of the tender is a Franklin booster.

In a typical test one of the new locomotives handled 90 loads and 14 empties, or a total tonnage of 6,087, over the hump in 40 min. at a speed of two miles an hour, 360 lb. of coal being used in firing the engine six times. Slack was taken once to start the train; the total time of operation of the booster was 15 min. In general, one of the three-cylinder switchers will handle 40 more loaded cars than the two-cylinder, eight-wheel switcher previously used on this job, and under summer conditions will start all of the cars which can be placed on the longest and hardest track at Gibson yard and then not be worked to capacity.

Very little maintenance work has been required on these locomotives to date. The back ends of the inside main rods have been reduced after a wear of ⅛ in. Floating bushings on the outside main rod back ends are worn about 3/64 in. The locomotives have ample boiler capacity for the slow-speed service for which they were designed and respond promptly to the throttle, which greatly facilitates short switching and trimming. Owing to the relatively short wheel base, they can successfully negotiate sharp curves.

The principal weights, dimensions and proportions of the new locomotives are given in the table:

Table of dimensicns, weights and proportions of the Indiana Harbor Belt three-cylinder switching locomotives

Railroad	Indiana Harbor Belt
Type of locomotive	0-8-0
Service	Switching
Cylinders, diameter and stroke	1—23½ in. by 28 in. 2—23½ in. by 32 in.
Valve gear, type	Baker
Valves, piston type, size	12 in.
Maximum travel	6¾ in.
Outside lap	1¼ in.
Exhaust clearance	0 in.
Lead in full gear	⅛ in.
Weights in working order:	
On drivers	294,000 lb.
Total engine	294,000 lb.
Total engine and tender	515,300 lb.
Wheel bases:	
Driving	16 ft. 4 in.
Total engine	16 ft. 4 in.
Total engine and tender	56 ft. 9¾ in.
Wheels, diameter outside tires:	
Driving	57 in.
Journals, diameter and length:	
Driving, main	11 in. by 14 in.
Driving, others	11 in. by 14 in.
Boiler:	
Type	Wagon top
Steam pressure	200 lb.
Fuel	Bit. coal
Diameter, first ring, inside	86 in.
Firebox, length and width	102⅛ in. by 102¼ in.
Tubes, number and diameter	315—2 in.
Flues, number and diameter	50—5½ in.
Length over tube sheets	16 ft.
Grate area	72.5 sq. ft.
Heating surfaces:	
Firebox	220 sq. ft.
Arch tubes	28 sq. ft.
Tubes	2,624 sq. ft.
Flues	1,145 sq. ft.
Total evaporative	4,017 sq. ft.
Superheating	953 sq. ft.
Comb. evaporative and superheating	4,970 sq. ft.
Tender:	
Style	Water bottom
Water capacity	12,000 gal.
Fuel capacity	15 tons
General data estimated:	
Rated tractive force	Engine—75,700 lb. With booster 89,500 lb.
Weight proportions:	
Weight on drivers ÷ total weight engine, per cent	100
Weight on drivers ÷ tractive force of engine	3.88
Total weight engine ÷ comb. heat. surface	59.1
Boiler proportions:	
Tractive force (engine) ÷ comb. heat. surface	15.2
Tractive force (engine) × dia. drivers ÷ comb. heat. surface	868
Firebox heat. surface ÷ grate area	3.42
Firebox heat. surface, per cent of evap. heat. surface	6.2
Superheat. surface, per cent of evap. heat. surface	23

Foremanship and supervision

Advantages of the conference type of educational work for foreman and executives

THE *Railway Mechanical Engineer* is frequently asked how foremanship classes or study groups can best be conducted. Much depends, of course, on the peculiar conditions which exist at the point where the study is to be carried on and as to just what are its objectives. Possibly no one person has had more experience in conducting groups of this kind that Frank Cushman, chief of the trade and industrial education service of the Federal Board for Vocational Education. Incidentally, he has been associated with several groups of railroad shop foremen and has made a most distinct and favorable impression upon them. He has just written a book entitled "Foremanship and supervision"* which will be warmly welcomed not only by those who have profited by being in his study groups, but by all those who are interested in promoting movements for the study and discussion of problems concerning industrial leadership.

The book is designated by a sub-title as "a practical handbook for foreman conference leaders and supervisors of vocational education." It is this and much more. It can be read with profit by all those who have a responsibility for bringing up the standards of supervision. Mr. Cushman shows clearly the place that the the conference procedure has in the field of vocational education. It "consists essentially of a systematic, though somewhat informal, thinking through of problems by a group of experienced persons."

The general objectives of conference work are stated by Mr. Cushman as follows:

(1) Securing a composite opinion which may be used directly in establishing a new policy or modifying an existing policy. (2) Modifying the viewpoint of some or all of the group members for the purpose of securing better teamwork in the organization. (3) Helping each group member to analyze his job, identify his responsibilities, and discover better and more effective ways of meeting his responsibilities. (4) Assisting each individual member of a group to organize his experience to the end that it may be of increased value to him on the job. (5) Making analyses of situations or cases involving joint responsibilities in order to secure a smoother working organization.

The book is divided into three sections. The first part, roughly about one-third of the book, describes in great detail exactly how the conferences are set up and conducted. The last two chapters of Part I are concerned with a discussion of the factors which make for the success of conference work and the results which may be expected from it. The second part of the book—105 pages—considers the application of the conference procedure to the improvement of foremanship. It includes a large amount of carefully selected material from Mr. Cushman's wide experience and observation in the way of samples of the outlines of the objectives of pertinent conference topics, samples of blackboard work (the blackboard is an important factor in the success of the discussion group) and explanations of it, cases and questions which have been found to work well in conference work, and a few reproductions of actual analyses of the discussions. The third and smallest part of the book considers the application of the conference methods or procedure to work with vocational supervisors, apprentice supervisors and tenders.

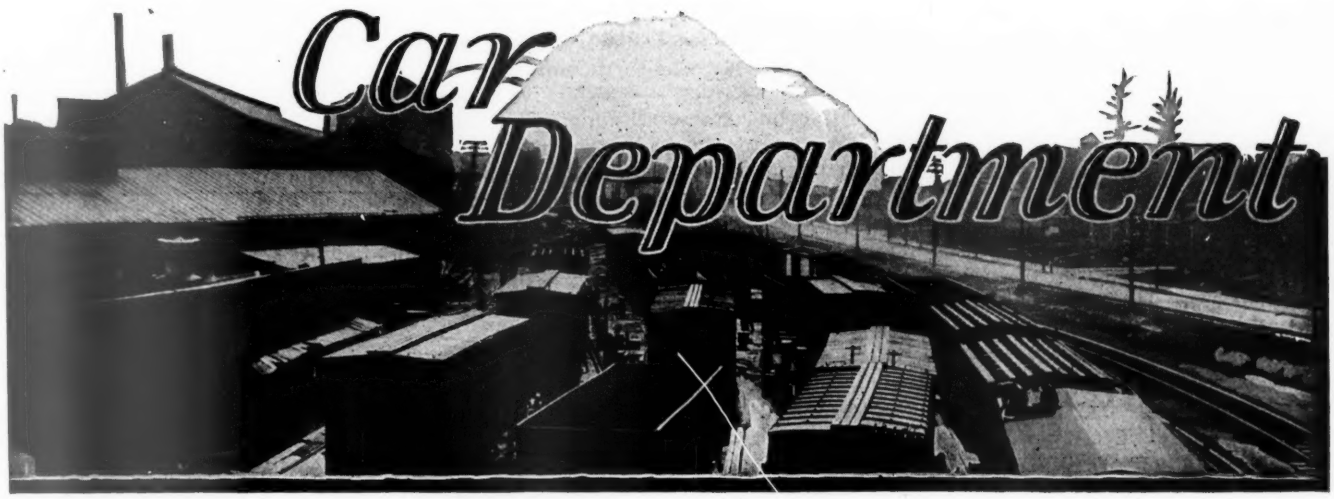
One of the first questions to be asked by those who are interested in starting foremen's discussion groups and clubs is as to where to find the right kind of a leader. It is not surprising, therefore, to note that Mr. Cushman loses little time in approaching this difficult and troublesome question. The leader's task is no easy one. It is his job to draw out the group, to see that each member makes his contribution freely and frankly, and to skillfully, but unobtrusively, steer the discussion in such a way as to stimulate the greatest possible amount of concrete thinking on the part of each individual in the group in attempting to reach the objectives or the answer to particular problems under discussion. This is a difficult job and requires a man of some special ability and talent. When such a man is located he must receive special training in leading conference groups.

Fortunately pioneers in vocational training like Mr. Cushman have appreciated the difficulty in finding and training conference leaders and a number of intensive conferences for training conference leaders are now scheduled more or less regularly each year in various parts of the country. Such conferences will not make leaders, but they will supply the requisite training for men of leadership ability. A summary at the end of the chapter on "The job of a conference leader" contains 16 items on the basis of which the success of the conference leader may be measured.

As a matter of fact this whole problem of helping officers and supervisors to become more efficient and effective leaders must be approached with tact and diplomacy. Such men take a real pride in their positions and are quite likely to take offense if approached in the wrong way. The leader does not presume to bring information to the group in the conference method of training. His task is to draw out the information from the group of experienced supervisors and get the members to analyze and classify it—the success of the conference method depends on the extent to which the members do constructive thinking or the problems which are considered. Obviously the topics discussed should deal with specific problems in which the group is interested and not in generalities. The objective of a foremanship conference is to "develop the capacity of the foremen to use their heads on the job.

Of especial interest to railroad men will be the various comments and illustrations in the books taken from Mr. Cushman's contacts with railroad groups. The frontispiece of the book, for instance, shows a foremen's conference at the Sacramento, Calif., shops of the Southern Pacific. Among quotations from executives as to the value of foreman conferences is the following: "The clear-sighted method employed in probing inter-departmental difficulties and in solving every-day problems that arise; the manner of showing the advantages of co-operation between department heads; the bringing to light of facts that mean a great deal in the efficient operation of railroad shops, which hitherto had been obscured in the dim light of misunderstandings and pretty disputes, all tended to heighten the morale of our shops and left an impression on our foremen that will be far-reaching in its effect and lasting in its duration."

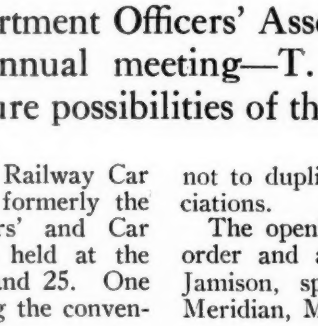
* Published by John Wiley & Sons, Inc., New York, 1927, 234 pages, $2.50.



Car men convene at Chicago

Railway Car Department Officers' Association holds usual constructive annual meeting—T. W. Demarest outlines future possibilities of the association

THE 26th annual convention of the Railway Car Department Officers' Association, formerly the Chief Interchange Car Inspectors' and Car Foremen's Association of America, was held at the Hotel Sherman, Chicago, August 23, 24 and 25. One of the most important single events during the convention in its bearing on the activities of the association was the address by T. W. Demarest, general superintendent of motive power of the Pennsylvania, who said that this organization of railway car men, as now constituted, has a real function which if successfully carried out will assure the hearty support of the highest railroad mechanical officer. Mr. Demarest said that the scope of the work of the American Railway Association, Mechanical Division 5, has changed to such an extent that the division now gives its attention almost exclusively to engineering problems of a more or less technical nature. As a result, the average car foreman and inspector would not feel free to discuss his particular trials and problems before the division, even if time were available on the program for such discussion. Between the mechanical division and no association at all, therefore, there is apparently a field for an organization to take the place of the old Master Car Builders' Association and serve as a clearing house for the ideas and opinions of car department supervisory officers and inspectors. Mr. Demarest felt that the Railway Car Department Officers' Association, composed as it is of car men from all parts of the country, may well aspire to fill the need for an association of this kind. He urged that the general policy be adopted of not restricting the meetings to a discussion of interchange rule and also that in selecting topics for discussion, particular care be taken not to duplicate or overlap on the work of other associations.



B. F. Jamison (Southern)
President

The opening session of the convention was called to order and a brief address made by President B. F. Jamison, special traveling auditor of the Southern, Meridian, Miss., who emphasized the educational opportunities afforded by membership in the association and active participation in the meeting. Following the president's address, W. H. Getchell, assistant to the vice president of the Southern, made a stirring appeal for the co-operation of railway car inspection and car maintenance forces in reducing the serious drain on railroad resources occasioned by defective and improperly loaded cars, with resultant loss and damage claims. These claims on the Southern have been reduced in the past few years from five to less than one per cent of the gross revenues, largely by co-operation of all concerned and attention to minor details, apparently of little importance. Mr. Getchell illustrated how these minor defects, resulting in damage claims, can be overcome and asked for higher standards of car maintenance, closing his remarks with a tribute to the character and efficiency of the modern car man on whom depends, to a considerable extent, the possibility of further reductions in loss and damage claims.

Other addresses and papers presented at the convention, which will be abstracted in this and subsequent issues of *Railway Mechanical Engineer,* include Selection and Conditioning of Cars for Loading, by W. J. Owens, chief interchange inspector, Peoria, Ill.; Shop Efficiency, by E. G. Chenoweth, general foreman, Chicago, Rock Island & Pacific, Chicago; Lubrication, by M. J. O'Connors, mechanical inspector, New York Cen-

tral, Buffalo; Loading Rules, by C. J. Nelson, chief interchange inspector, Chicago. In accordance with its usual custom, the association also devoted two sessions to a discussion of American Railway Association rules of interchange and the report of the question box committee.

Election of officers

The following new officers were elected: President, E. R. Campbell, chief interchange inspector, St. Paul, Minn.; first vice-president, M. E. Fitzgerald, general car inspector, Chicago & Eastern Illinois, Danville, Ill.; second vice-president, F. A. Staff, supervisor of reclamation, Chesapeake & Ohio, Covington, Ky., and third vice-president, M. P. Cole, general car inspector, Boston & Maine, Ayre, Mass. A. S. Sternberg, master car builder of the Belt Railroad of Chicago, was re-elected secretary-treasurer.

Comments on loading rules

By C. J. Nelson
Chief interchange inspector, Chicago

The American Railway Association has devoted many years to formulating a code of rules to provide safe and uniform methods for loading the enormous number of various commodities manufactured in the United States and Canada, and you, of course, know that this important work is assigned to members of the association who comprise the Loading Rules Committee.

In practically every case the committee conducts exacting investigations extending for months and sometimes for years before a rule is submitted to the American Railway Association for approval; safety is always given first consideration followed by ascertaining the

E. R. Campbell (Minn. Transfer) 1st vice-president

M. E. Fitzgerald (C. & E. I.) 2nd vice-president

most practical and economical loading methods. After the committee has agreed upon what appears a satisfactory method, the forwarding of test loads is arranged for, the loading of same, as a general rule, being supervised by one or more members of the committee who also arranges to obtain complete information covering the condition of such loads en route and at the finale destination.

The committee frequently holds meetings and many conferences with the shippers, but I doubt that the excellent relations between the committee and the shippers, and the splendid help volunteered by the shippers is as well known and appreciated as it should be, and I feel safe in saying that if the carriers will do their part, cooperation on the part of the shippers will surely be forthcoming.

Extensive educational campaigns are continually being conducted by the railroads for the purpose of having the many rules by which their employees are governed thoroughly understood, which, however, has apparently been allowed to go by default to a greater or less extent so far as the loading rules are concerned. The reason for this is hard to understand, because it seems reasonable to assume that where so much is at stake, such as,

W. R. McMunn (N. Y. C.) 3rd vice-president

A. S. Sternberg (Belt Ry. Chicago) Secretary

detention of loads, wrecks, destruction of property, and the possible loss of life, these rules should be given preferred consideration.

I believe it can be said without fear of contradiction that very few meetings are held for the purpose of discussing the loading rules in regular order along the same lines as the interchange and other rules are discussed, and that some roads hold no such meetings at all. While it is a fact that the Loading Rules Committee endeavor to simplify the rules as much as possible, it is, nevertheless, practically impossible for the employees in the ranks to interpret many of them correctly without assistance from someone familiar with the details. The cuts or drawings accompanying the rules are deemed very necessary in order to indicate specific requirements, but it would probably be surprising to many to know that a large number of employees in contact with this line of work are unable to understand them. I am firmly convinced that the only way to accomplish the desired results is to hold periodical meetings with station agents, their employees, and the carmen; having such meetings conducted by someone competent to thoroughly explain each rule and drawing, also to outline clearly just how commodities should be loaded as well as how they should be handled en route and at interchange points.

Knowing as we do how vigorously the managers of our railroads have struggled to attain the highest possible point of efficiency, and how earnestly they have repeatedly appealed to their employees for suggestions, making for economy and for the general welfare of the public, I feel that every member of this nationwide association is duty bound to take immediate action towards bringing to the attention of his managing officers the fact that efficiency and economy can be further increased to no small extent, by all concerned fully appreciating the value of the Loading Rules, and just what is required in connection with them.

Conditioning cars for loading

By W. J. Owen

Chief joint inspector, Peoria & Pekin Union, Peoria, Ill.

The careful selection, inspection, and preparation of cars for loading starch, feed, sugar, flour and other high class products to insure this protection is of the utmost importance. The interest of both carrier and shipper is mutual in this respect; consequently, the use of unfit cars—even when the need may appear to be pressing—cannot be justified, as it usually means damaged freight, dissatisfied customers, and the consequent losses to all parties concerned.

Car inspectors are dircetly responsible for the proper selection and classification of cars and the fitness of a car for loading any commodity can be determined only by a thorough interior and exterior examination by a competent inspector.

There should be a standard set of rules or specifications for the classification of empty box cars, a copy of which should be furnished all inspectors. This is necessary in order to bring about a uniform classification of cars by all inspectors and should be worked up to meet local and general conditions. This standard specification for selecting empty box cars brings about a more common understanding among all inspectors as to the proper classification of each car, thereby avoiding the reclassification of many cars after being set to an industry for loading and the elimination of any unnecessary switching or handling of cars. All box cars should immediately be inspected when made empty at the team tracks, freight houses, industries, or other unloading points and commodity cards applied showing the lading for which car is suited. Where no inspectors are located at unloading points, such inspection and classification should be made at train yard, interchange track, or the first available place to avoid delays to and extra handling of equipment by transportation department.

The following is suggested as a guide for classification of cars:

First—Roofs should be in first class condition and water tight and close inspection should be made to see that there are no stains on plates, ridge pole, carline, or roof lining indicating leakage. Care should be given not to disqualify a car for such old stains where a new roof has been applied.

Second—Side doors and all attachments must be in good condition and as nearly water tight as possible. See that there are no broken, split, or spread boards in door sheathing.

Third—Framing post, braces, and belt rails must be in good condition, in place and secure.

Fourth—Side and end sheathing must be in good condition and water tight. See that there are no broken boards, boards with weather splits or boards loose, warped and spread apart.

Fifth—Floors, side and end lining must be in good condition and free from loose and broken boards, tin patches, loose nails, plates, bolt heads, screws, and split or sharp ends, cleats on floor or lining or other conditions that cause projection beyond inside face of floors and lining.

Sixth—Floors and lining should be free from bad odor, acid spots, oil, creosote, fertilizer, manure, lime, hides, filth, or other substance liable to cause loss or damage to lading. Car interiors should also be as free as possible from dust or dirt from previous loading of cement, starch, grain, coal, salt, charcoal, clay products, and other such ladings.

It would not appear a difficult matter to select sufficient cars answering these specifications to keep the industries well supplied, but we find it is not only difficult but increasingly so. This condition is the result of cars having been previously loaded with ladings that would later disqualify them for high class commodity. This is a question worthy of the attention of our superior officers and every effort possible should be made to discourage the loading of first class cars with ladings that will damage the interior of the car.

There are many cars with what might be termed "defects in construction"—conditions which make the car unfit for high class loading. An unlined metal end, metal straps on floor, angle irons connecting side and end belt rails, square head bolts for ladders, door stops, and grab irons where they project beyond inside surface of floor or lining; single sheathed cars where side sheathing has been reset and old bolt holes not properly plugged. A great improvement could be made in the attention given belt rails when cars are repaired or rebuilt. We find many cases where old belt rail plank are left in cars; these plank being split, broken and having splintered edges and others where new belt rails are applied the screws are not set straight; they stand at an angle and this permits one side of the screw head to project beyond surface of plank. Square or sharp cornered grain door nailing strips should preferably be made of finished lumber with rounded inside edges. Nothing is more useless than to drive in old floor nails. The first movement of the car will again work the nail out, causing damage to lading. All of these conditions are a menace to sack commodity loading.

When an order is placed for a number of cars to load with certain high class products it often happens that not sufficient cars in condition for immediate loading are found. To handle the matter it is then necessary to select cars with minor interior conditions that render them unfit for the intended lading and arrangement made to correct these defects.

In conditioning cars for high class products all broken lining or broken flooring boards should be renewed; loose lining and flooring should be renailed; all cleats, blocks, tin patches, loose or protruding nails removed from floor and lining; bolt heads, strap, belt rail screws, rough or splintered edges of belt rails and lining; or any other conditions liable to tear or damage lading should be covered with pads of paper, burlap, or similar material.

Dirty condition of ceiling, lining, and floor should be removed by sweeping or blowing out with air. Light greases or oil spots on floor and lining, where they have not penetrated through the board, can be removed by washing with water and a cleaning compound.

Boston & Maine to analyze repair costs

It is usually rather difficult to determine just how much it is costing a railroad to maintain any specific series of freight cars, or for what proportion of the total different parts are responsible. When the cars are repaired on foreign lines, the A. R. A. billing repair cards are passed through the M. C. B. clearing house for approval. The cards are mixed with many others coming in from all parts of the country, thus making it a rather tedious task to pick out the cards covering a certain series of cars.

L. Richardson, mechanical superintendent of the Boston & Maine, has placed in effect a simple scheme for checking up the maintenance costs of eight series of

cars. He selected a number of cars from each of the following series:

No. selected	Types of cars
25	Box, steel center sills
50	Box, steel underframes
25	Box, 40 ton
25	Box, new A. R. A.
25	All steel gondola, 40 ton
25	All steel gondola, 50 ton
25	U. S. R. A. coal cars
25	Flat

The Boston & Maine designation has been removed and the cars have been stencilled "Mystic Transportation Company, at home on the B. & M.," which provides a guide to foreign lines in billing for repairs. The cars stencilled are all in good condition. The A. R. A. billing repair bureau has the numbers of these cars and special accounts have been provided for them. Whenever a billing repair card comes in bearing the "M. T. C." initials, the billing clerk will enter the charges in the proper special account. Any repair cards originating on the home lines will also be similarly marked and accounted for. In this manner, an accurate record will be kept of the maintenance cost for these cars with no increase in personnel and with a minimum amount of extra work.

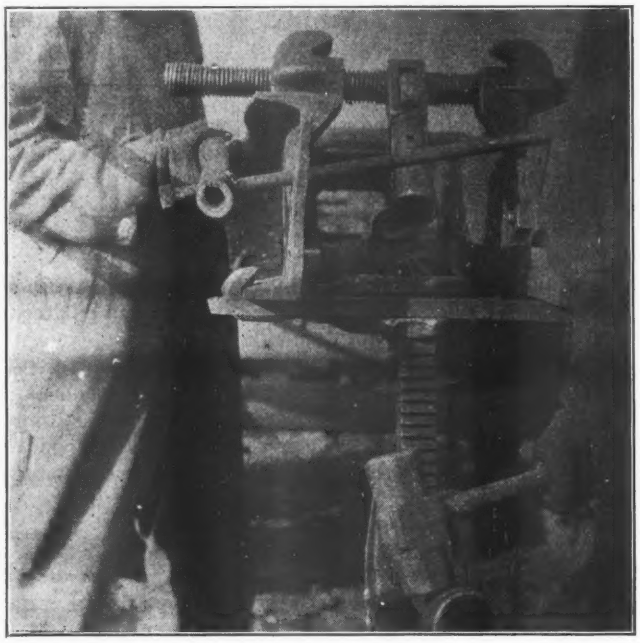
The costs will be carefully sub-divided by parts of the cars. A monthly report will be submitted to the mechanical superintendent by the A. R. A. bureau. By making a careful analysis of these reports it is hoped to determine what parts of each series require abnormal maintenance and then steps will be taken to reduce the excessive costs either by redesigning the part or specifying new materials.

Building up collars on car axles by welding

A DEVICE for rotating car axles during the process of building-up by oxy-acetylene welding is shown in the sketch. This device was developed by one of the employees of the Lehigh Valley shops at Sayre, Pa. It consists essentially of two steel horses 25 in. high on which are mounted three sets of wheels as shown in the sketch. One of these horses is placed under each end of the axle. Each wheel fit is carried on two wheels placed together in a single bracket. The wheel nearest to the operator is toothed, and has four holes drilled in the rim in which a small bar may be inserted. To rotate the axle the operator pulls on the bar which is inserted in one of the holes in the toothed wheel, until the axle has been rotated to the desired position. The operator does not have to change his position or exert much effort to rotate the axle. As shown in the sketch, the horses are made with three sets of wheels which permits welders to work on from one to three axles at a time.

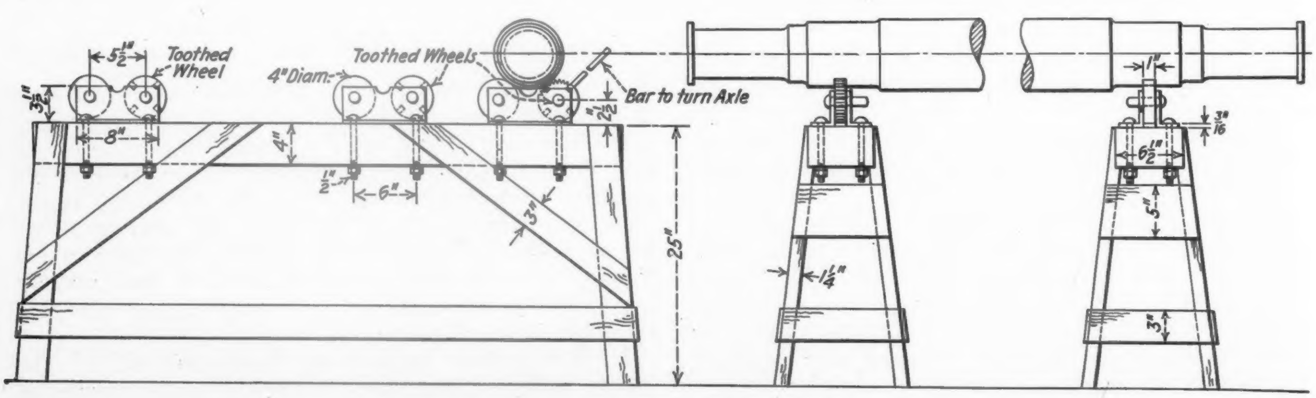
Removing rivet hole bulges from draft sills

IN cutting the lugs from the draft sills of freight cars preparatory to rebuilding them, the edges of many rivet holes are forced inward in punching out the rivets. The resultant small humps are very hard to straighten because the two sills are too close to each other to permit the use of a sledge on their inner surface. This difficulty is readily overcome by the use of a bolt or bar of steel small enough to go through the rivet hole



A simple device for quickly and safely removing rivet hole bulges from draft sills

in one of the sills and to reach the surface of the other, leaving enough of the bolt at the back end for the addition of a short section of air hose which is used as a handle by cutting a round hole through the hose and passing the rod through it. In this way the rod can be easily struck with a sledge without endangering the hands of the man holding it. When the surface of the sills are heated the small bulges are easily flattened out.



Device for rotating axles while welding the collars

Passenger truck repair shop of the Chicago & North Western

Passenger truck work facilitated

Fifteen-ton overhead traveling crane saves time and labor in handling truck repairs

At the Chicago shops of the Chicago & North Western, a 15-ton overhead traveling crane has recently been installed in the north end of car shop building C-6, devoted to the handling of passenger car truck repairs, and this crane together with other labor-saving devices and a carefully-organized truck repair gang makes possible an unusually efficient operation. Thirty car men, working 44½ hours a week, turn out an average of 22 pairs of four and six-wheel trucks a week, all of this work consisting of heavy repairs or complete rebuilding. Light repair trucks are handled in addition.

Before the installation of the traveling crane, furnished by the Northern Engineering Works, Detroit, Mich., the operations of unwheeling and wheeling trucks and handling heavy material were both difficult and time consuming. Air jacks had to be used, and it was practically out of the question to move trucks about in the shop even when such movement would have been helpful in getting trucks out and thus increasing the truck shop capacity.

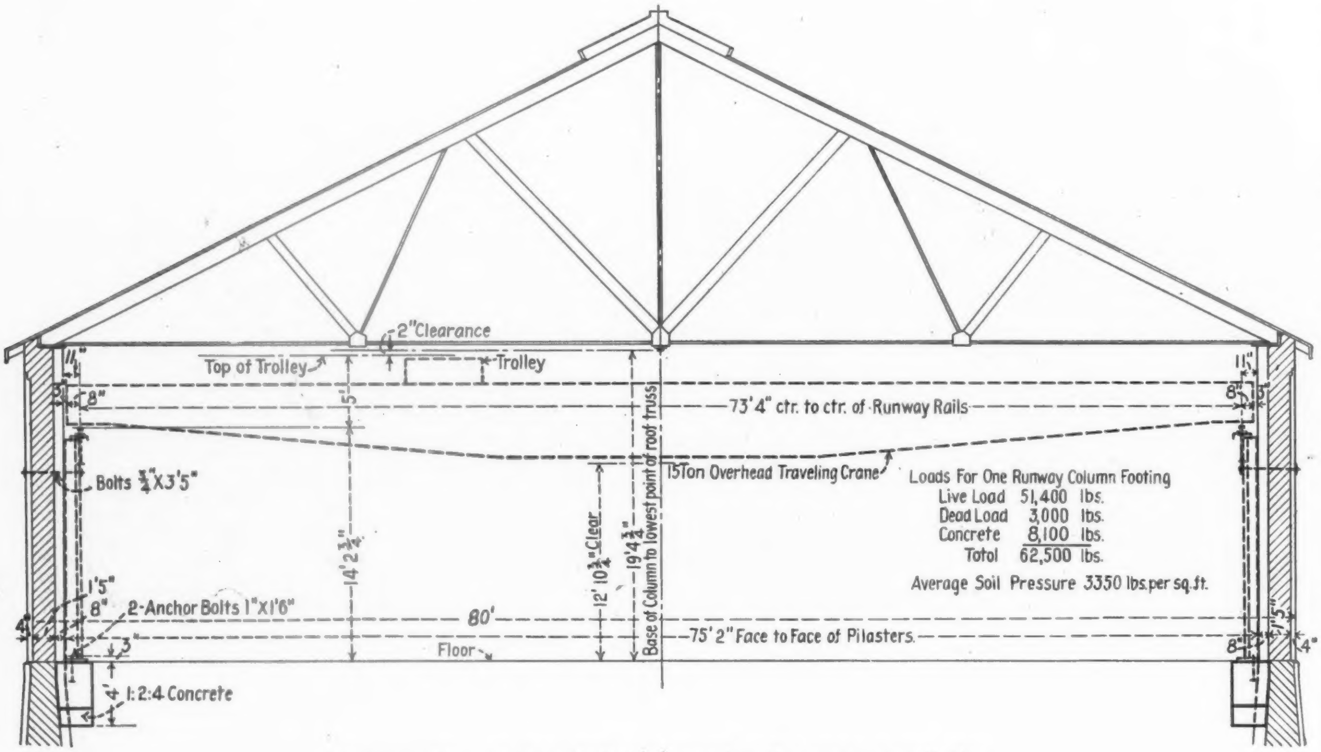
Passenger truck work at the Chicago shops is carried on in an old shop building 80 ft. wide, six tracks in the north end of which are devoted to this work. These tracks are spaced 20 ft. on centers and two trucks are normally in the process of repair on each track, although in case of bad weather or emergency two pairs of trucks can be accommodated on each track. Referring to the drawing, the method of installing the runway and 15-ton overhead traveling crane is illustrated. The span of the crane, which is of the gap type, is 73 ft. 4 in., center to center of the runway rails, and the clear height at the center of the crane, 12 ft. 10¾ in. In the illustration, light lines indicate old construction and heavy lines, new. The speed of the hoist is 20 ft. per min.; the bridge travel, 125 ft. per min.; trolley travel, 200 ft. per min., and maximum hook lift, 14 ft. 11 in., made possible by the gap construction of the bridge crane and necessary in order that wrecked trucks may be lifted directly from gondolas in the truck shop without the rehandling and several moves formerly necessary.

Other labor-saving equipment

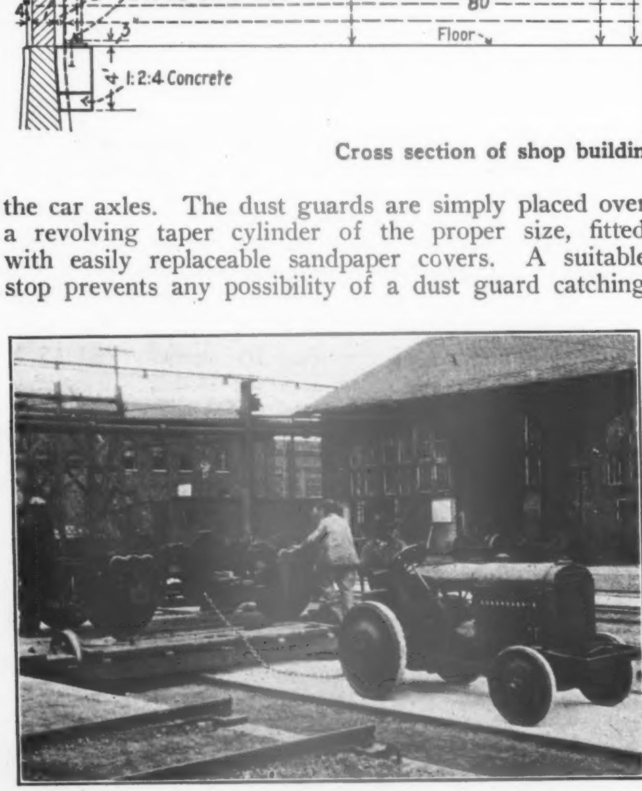
In one corner of the north end of the shop is the foreman's office, and along the north wall adjacent to the office is located a substantial work bench with suitable storage bins for bolts, nuts and other material used in truck repairs. In this section of the shop is also located a pneumatic press for compressing elliptic springs so that they can be clamped before application to the truck bodies. A small gas furnace is provided for heating the rivets used in applying journal box covers, and in the corner opposite the foreman's office are located the equipment and supplies used by the car man helper responsible for journal boxes. A shop-

made drill press enables small drilling and counterboring operations to be performed without taking work to and from the car machine shop. One small machine on the work bench which saves time and, in particular, promotes better workmanship, is the air motor-driven sanding machine for fitting dust guards accurately to the car axles. The dust guards are simply placed over a revolving taper cylinder of the proper size, fitted with easily replaceable sandpaper covers. A suitable stop prevents any possibility of a dust guard catching and revolving with the cylinder. All of these devices contribute to a better quality of work and save time and labor in handling truck repairs.

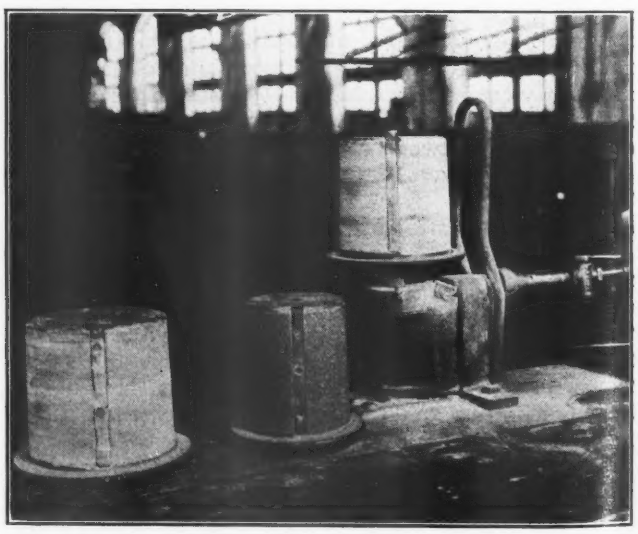
In passenger truck repairs no attempt is made to specialize the work or the men. Any truck can be repaired on any track, and all truck repair men are trained to handle the rivet hammer and any phase of truck repair work. The only specialist in the gang is the man who cleans and repairs journal boxes and is responsible for this item alone. Of the 30 car men employed in the truck shop at the present time, four are helper apprentices who are not assigned to any special job but help and are taught in all phases of the work.



Cross section of shop building showing the crane installation

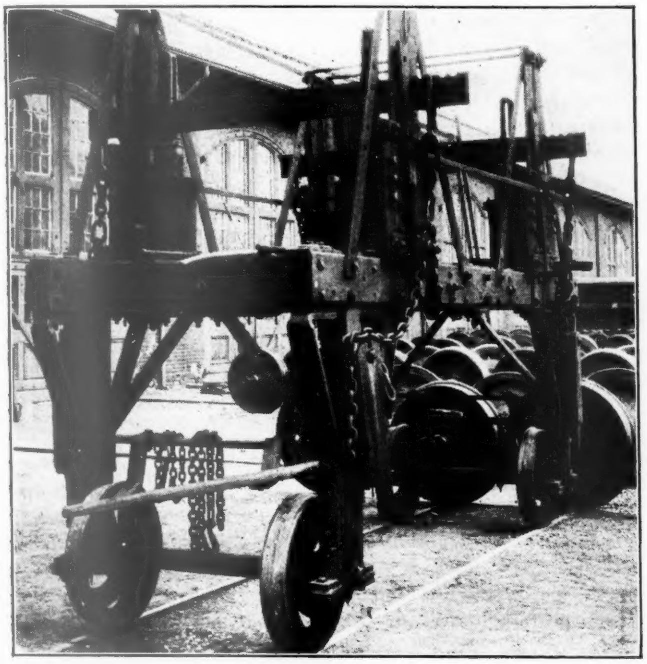

McCormick tractor and one of the small transfer tables used in moving trucks

In organizing the work, three men are, as a rule, assigned to each truck and stay with it during the entire operation of overhauling. One man works on each side and the third is responsible for work on both ends. This arrangement is found to work out satisfactorily, preventing the men from getting in each other's way and practically eliminating lost time. Trucks arrive in the shop in all kinds of condition and sometimes the work necessary on the sides is more extensive than that on


Sander for fitting dust guards accurately—Method of attaching sandpaper is indicated—Three cylinder sizes are shown

the ends or vice versa. Usually, the side men get through first and then work on bolsters, polishing journals, fitting dust guards, brasses, etc.

As soon as cars are received at the shops for general repairs, the truck shop foreman or his assistant determines by inspection how extensive repairs are necessary

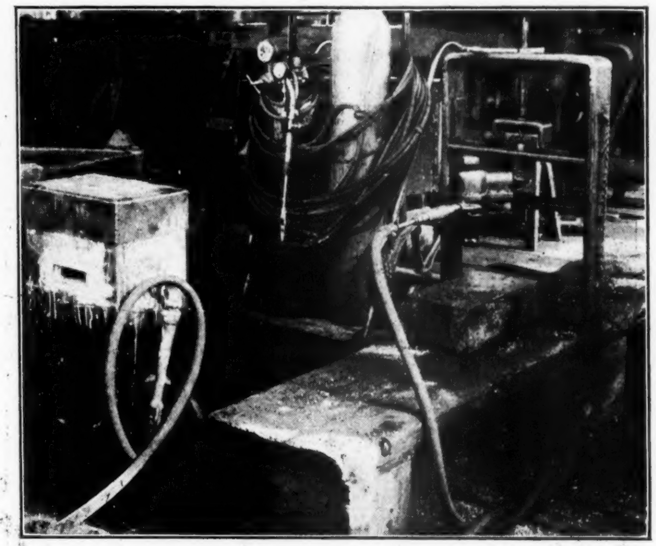


Air-operated device for moving trucks from one track to another at the side of the shop where no transfer table is available

and this information subsequently makes it possible to balance the work in the truck shop. The foreman also makes a note of any material needed which is not in stock and places the necessary orders. Most of the material, however, is ordered after the inspection of the dismantled truck in the shop.

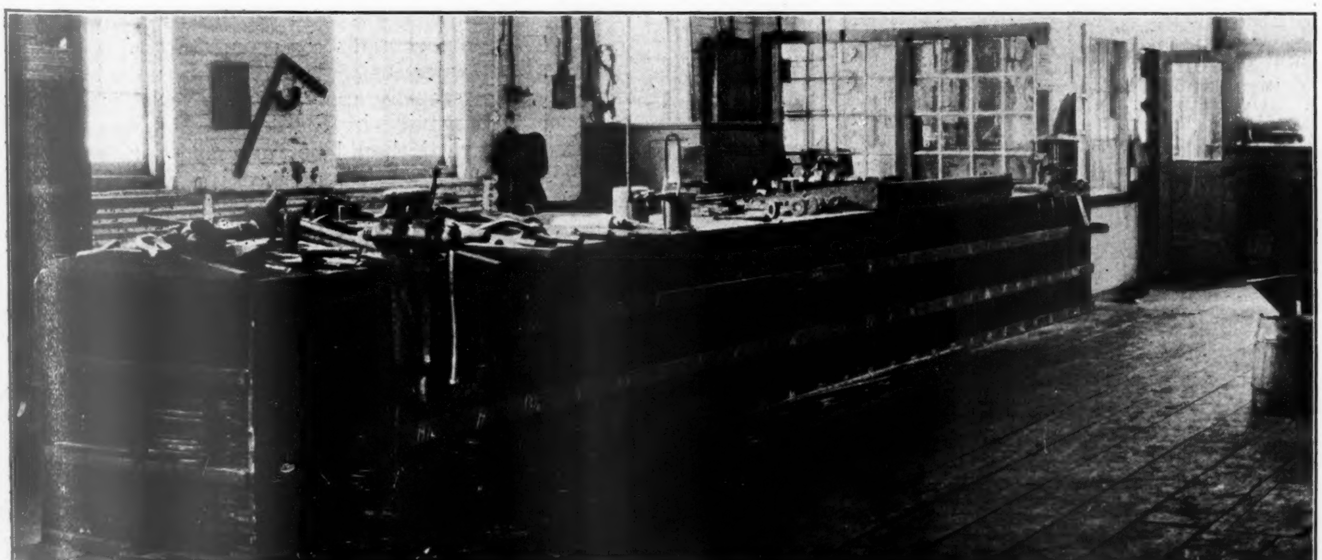
Method of operation

The trucks are moved into the shop by means of a small transfer table and wire rope block operated by a McCormick tractor. The first operation consists in cutting the pedestal strap nuts or bolts off with an acetylene torch, which can be done in a fraction of the time required to remove the nuts by hand and which does not cause excessive material loss, inasmuch as the bolt threads are practically always battered and in such a condition as to be unfit for further service. The shop crane is then moved over the truck and four chains equipped with claw grab hooks fastened behind the links. The truck is lifted, wheels rolled outside the shop and the truck set down on horses at a height most convenient for working. The foreman or his assistant inspects the truck carefully and marks in yellow crayon the parts to be repaired or renewed and this work of replacement then progresses quickly and without interruption, as care has been taken in advance to know that the necessary repair material is available.



Shop made drilling device, furnace for heating journal box cover rivets and oxy-acetylene equipment truck

Spring hangers, crossheads, pedestal slides and brake beams are parts which wear most rapidly and require repair and replacement on practically every truck. They have been standardized to an unusual extent on the North Western and this enables a stock to be kept on

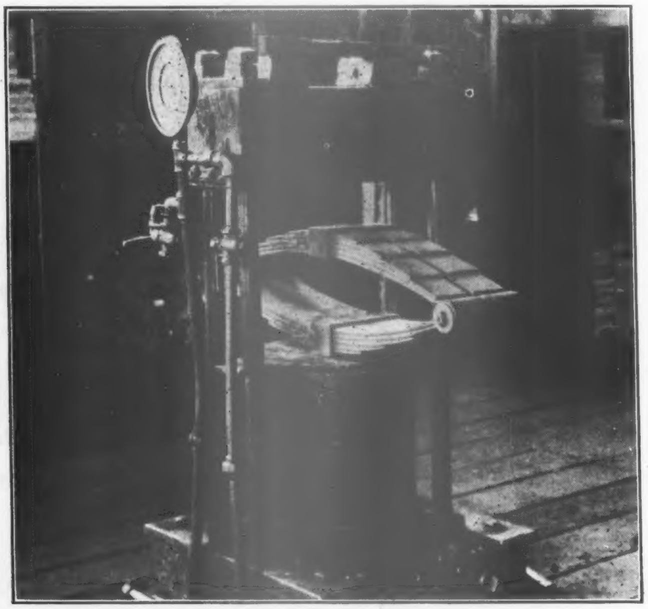


Truck shop office, work bench and material storage bins at the Chicago passenger car truck shop of the C. & N. W.

hand and furnished to the truck men without delay. Worn equalizers are sent to the blacksmith shop and built up or reforged to standard. Springs, both coil and elliptic, are tested before being placed in the truck to see if they are up to standard capacity. Coil springs which do not meet the test are scrapped. Elliptic springs which fail are sent away to be reconditioned.

Wheels handled by tractor gang

The car wheels, in the meantime, have been inspected and sent to the wheel shop where wheels and journals are turned where necessary. After being gaged and marked, two or three pairs of wheels of the same diameter are selected for each truck and spotted outside of the truck shop by the tractor gang, whose responsibility is to watch the progress of the truck repair work and see that the necessary wheels are available when needed. This gang, with the assistance of the McCormick tractor, also handles other heavy material to and from the truck shop and operates the small transfer tables used in setting trucks on the different shop tracks. The



Pneumatic press for compressing elliptic springs before application to trucks

use of this tractor in moving trucks between the cars and truck repair shop has resulted in a saving of labor equivalent to the services of four men.

When ready to be rewheeled, each truck is lifted again with the shop crane and set down on the wheels, to which journal boxes and brasses have previously been fitted and applied. The pedestal straps are hung loosely in place and the truck moved by the tractor to the shop where the car to which the truck belongs is located. Trucks are applied under the car, gaged and after the car goes to the paint shop, regulated for spring adjustment and painted.

One of the illustrations shows a special pneumatically-operated device by means of which trucks are raised and transferred from one track to another at the side of the shop where no transfer pit and table are available. The truck is raised by air pressure in four cylinders and the device is moved from track to track by the tractor.

In case wheels lined up for the truck shop are not applied before closing time on any day, the journals are painted with oil to prevent corrosion of the highly polished journal. This takes place to a certain extent even over night and may seriously impair, if not ruin, the efficiency of the journals.

Schedule system effective aid

Mention should be made of the schedule system, without which the truck shop output would be materially lessened and the work of supervision made more difficult. A schedule board is located in the foreman's office and arranged with white, green or red buttons or plugs to indicate the progress of the work and cases in which it is delayed for lack of material or other reasons. This modern schedule system which works in conjunction with the main car shop schedule is a great aid in enabling the foreman to visualize the full scope of the truck shop work and concentrate on those features of it which apparently may be delayed or which, for other reasons, need his personal attention.

Decisions of the Arbitration Committee

(The Arbitration Committee of the A.R.A. Mechanical Division is called upon to render decisions on a large number of questions and controversies which are submitted from time to time. As these matters are of interest not only to railroad officers but also to car inspectors and others, the Railway Mechanical Engineer will print abstracts of decisions as rendered.)

Responsibility for wrong repairs

The Chicago, Rock Island & Pacific secured a joint certificate on C.R.I. and P. car No. 261412 reading as follows:

Description of wrong repairs	How repairs should be made
RL3-1 Non-A. R. A. brake beam to car.	1 A. R. A. No. 2 brake beam standard to car (stencilled).
1—7-in. by 21-in. truck brake lever.	2—6-in. by 18-in. truck brake levers L & R 3 and 4.
1—6-in. by 19-in. truck brake lever.	

The joint evidence certificate was accompanied by a Boston & Maine repair card which when presented to the owner read as follows:

R&L3—1 new A.R.A trussed brake beam No. 2, etc. One new dead lever

A request was made by the owner on the B.&M. for a defect card for wrong repairs which was declined by the B. & M. on the grounds that correct repairs had been made. The owner insisted that having no other record of any other company applying a brake beam, the joint evidence accompanied by the repair card was final and that a defect card should be furnished for the owner's protection. Again being refused protection by the B. & M., the C.R.I. & P. claimed the right under Rule 13 to render a bill charging the B. & M. for the cost of correcting the wrong repairs shown on the joint evidence certificate.

The Arbitration Committee stated that "the evidence is conclusive that the Boston & Maine is responsible for the wrong brake beam and one wrong lever." Decisions 1105 and 1207 are parallel.—*Case No. 1466—Chicago, Rock Island & Pacific vs. Boston & Maine.*

Another case under rule 32

On December 20, 1924, while in possession of the Chicago & North Western, El Dorado Refining Company car No. 121 received extensive damage to the coupler, A end, running boards at A end and left side.

running board support, draft gear and various safety appliances, which damage the C. & N. W. contended occured in ordinary switching service. The owner claimed that the damage to the car was caused by either collision or impact in coupling at a speed exceeding limits of safety, sideswiping or derailment which under the provisions of Rule 32 would be the handling lines responsibility. The handling line stated that the damage to the running boards and other parts repaired on the A end was caused by the car striking an adjacent car while being handled with a defective coupler and that Interpretation No. 7, Rule 32 clearly placed the responsibility for such damage with the owner. Furthermore, the car was not derailed, cornered or sideswiped or otherwise subjected to any of the unfair conditions enumerated in Rule 32.

The arbitration committee did not sustain the contention of the El Dorado Refining Company and, therefore, placed the responsibility on the owner.—*Case No. 1468—El Dorado Refining Company vs. Chicago and North Western.*

Joint evidence conclusive of wrong repairs

On December 13, 1923, the Charleston & Western Carolina welded one metal truck side on Atchinson Topeka & Santa Fe car No. 45368 for which a billing repair card was rendered. When the car arrived at its lines the A. T. & S. F. obtained a joint evidence within the time limit prescribed by the rules, covering this truck side as being improperly welded. The weld was not proper because the new metal had been laid in flush with the section welded, and was not reinforced as per Fig. 4 of Rule 23 which requires that on any parts subjected to high tension, the new metal supplied must be more than 1½ in. greater than the original thickness of the section being welded. The A. T. & S. F. also called attention to the fact that the billing repair card made by the repairing line did not show that the truck side was annealed. Paragraph E of Section 5, Rule 23, requires that they be annealed. On the other hand, the repairing line maintained that the owner's joint evidence alleging that repairs were not made which the handling line originally recorded in an A.R.A. billing repair card as having been made, is not a joint evidence of wrong repairs within the meaning or requirements of A.R.A. Rules 12 and 13, and cannot function as an improper repair joint evidence. The repairing line approved the agreed statement of facts prepared by the A. T. & S. F. with this understanding. Arbitration case No. 1289 bears out the contention that joint evidence which undertakes to allege repairs have not been made by a particular line or at a particular time cannot take precedence over the original record of repairs or of the billing repair card. The C. & W. C. also contended that the truck side was properly welded and stenciled, also that, had there been improper work done, the car would have been subject to refusal, under paragraph P, A.R.A. Rule 3, 1923 code.

The arbitration committee held the C. & W. C. responsible for the wrong repairs.—*Case No. 1469—Atchison, Topeka & Santa Fe vs. Charleston & Western Carolina.*

Labor charges in excess Rule 120 limits

The St. Louis-San Francisco billed the Missouri & North Arkansas for $908.49 and $1,420 for charges on three M. & N. A. stock cars, which exceeded the limit allowed under provisions of Rule 120. The owner declined payment of the bills and returned them for correction, under Section C, Rule 91, for the reason that the requirements of Rule 120 were not complied with. The M. & N. A. objected to the entire charges on the three cars for the reason that the repairing line failed to furnish an inspection certificate on any of the cars and failed to reinforce the cars as required for cars receiving general repairs, and stated that if interpretation No. 2, Rule 120, governs all cases of this nature, then Sections A, C, D, E, and F, and Interpretation No. 3 of Rule 120 should be stricken from the rules. The repairing line maintained that interpretation No. 2, Rule 120 should govern the case and furnished recharge authority for the amount exceeding the limit provided for.

The Arbitration committee rendered the following decision: "Inasmuch as there is no evidence of unfair usage, the bill of the St. Louis-San Francisco should be paid as rendered and adjustment made with the car owners on the basis of Interpretation No. 2 of Rule 120.

"Note.—The intent of Rule 120 is to afford owners the opportunity to decide whether cars shall, when requiring extensive repairs, on account of owner's responsibility, be repaired or dismantled. In the event a car requires repairs of this character, if there is a direct connection to the home line such bad order car, if safe to handle, should preferably be delivered to the owner for disposition."—*Case No. 1470—Missouri & North Arkansas vs. the St. Louis & San Francisco.*

Original damage caused by emergency brake application

The Reading Company billed the Union Railroad for $335.07 which was approved for payment on April 24, 1925. Among other charges included in the bill was one in amount for $60.92 covering repairs to Union Railroad car No. 5492. The owner objected to the charge as the nature of the repairs indicated that the car might have been damaged under some of the conditions mentioned in Rule 32. For this reason the repairing line was asked to advise the circumstances under which the damage developed and in replying furnished a copy of the report of the accident in which the car had been involved, showing that the knuckle of the first car in a train of 73 empties opened and permitted the engine to run away from the train. This caused an emergency application of air and the sudden stopping of the train caused the car in question to mount the car just ahead of it. The owner contended that the damage resulting from one car mounting another is unfair handling coming under the scope of Interpretation No. 4 of Rule 32, while the repairing line maintained that the damage resulting from such a cause is the owner's responsibility unless the superstructure of the car mounted is damaged as per Section 0 of Rule 32.

The Arbitration committee stated that this "case is parallel to Decision 1338 and the same ruling applies. The contention of the Union Railroad is not sustained. —*Case No. 1471—Reading Company vs. Union Railroad.*

Authority of defect cards is again sustained

On February 13, 1924, Missouri & North Arkansas car No. 2111 was offered empty to the owner by the St. Louis-Southwestern and rejected by the inspector for the M. & N. A. on account of defects denoting unfair usage and because no defect card was attached to the car covering the damage. On February 19, 1924, the car was accepted with a St. Louis-Southwestern defect card covering the following defects: Buffer plate broken, bottom nail girth broken, two metal side channels bent, two draft channels bent, six nailing girths broken, eleven

pieces of decking cut and broken, and one side ladder bent "B". Some time later, the owner submitted to the handling line a joint inspection certificate form dated April 17, 1924, which showed that two metal draft channels were broken and bent and that temporary repairs had been made by the Missouri Pacific on January 14, 1924, for which no bill was rendered. The handling line accepted the original defect card for cancellation and issued cards for all damage indicated by the joint inspection certificate. The owner's bill for repairs made on December 3, 1924, was, however, declined by the St. Louis-Southwestern, on the ground that responsibility for the damage rested with the Missouri Pacific on account of the car being in an accident on that line January 7, 1924, as indicated by the joint inspection certificate. The owner contended that, regardless of which company was responsible for the damage to its car, the St. Louis-Southwestern should honor its defect card in accordance with the spirit of interchange rules and that if it were not responsible for the damage to this car, this fact should have been established prior to the issuance of its defect card. The St. Louis-Southwestern stated that the reason for issuing the defect card was that, after several attempts to get the M. & N. A. inspector to accept the car, the foreman stationed at the interchange point, who was not thoroughly conversant with the case, in order to stop per diem charges and get rid of the car, decided to issue a defect card on the grounds that the St. Louis-Southwestern would be protected by rebuttal cards.

The Arbitration Committee stated that "the bill of the Missouri & North Arkansas against the St. Louis-Southwestern on authority of defect card, is sustained. The notation "Repaired temporary at Newport 1-14-24," as shown on the joint inspection statement furnished by the Missouri & North Arkansas to the St. Louis-Southwestern as evidence of the condition of the car, is questionable as it is not evident that the repairs made by the Missouri Pacific were temporary.—*Case No. 1472, Missouri & North Arkansas vs. St. Louis-Southwestern.*

Two-way side hinged dump car

Designed to carry load, directly on the center sill—Height above top of rail, 7 ft. 9⅞ in.

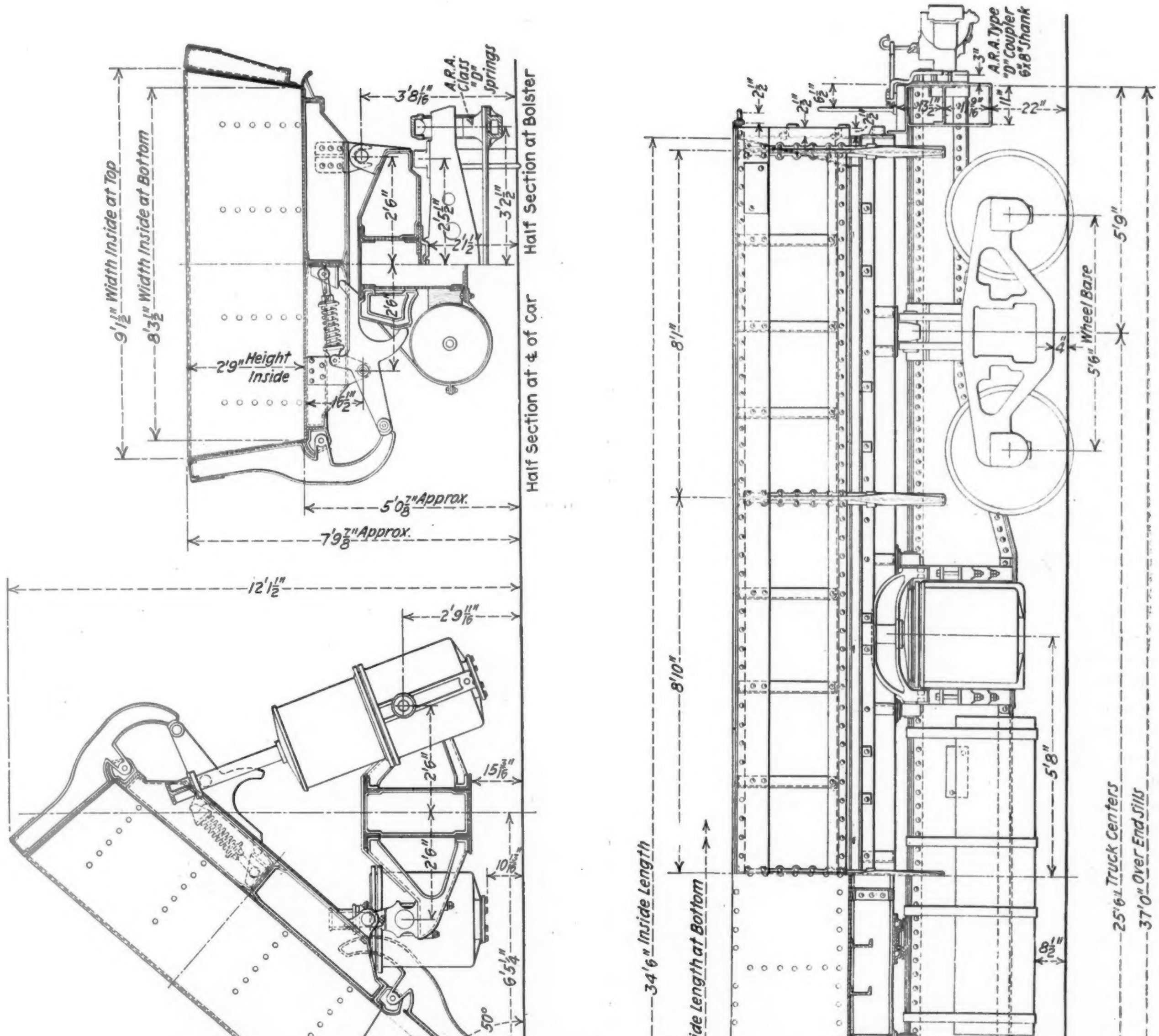
A NEW type of dump car, which is a departure in many respects from any of the types it has heretofore built, has been developed by the Magor Car Corporation, 30 Church street, New York. The builders, in designing this car, have eliminated entirely all forms of tension and compression locks and substitutes for them, and have developed a new principle of construction whereby the body has complete and stable support at all times during transit on the center sill of the car underframe. With this arrangement it is impossible for the cars to dump prematurely or while in transit. The new Magor cars are designed not alone for construction work and for handling material at terminals, but more particularly to meet the need for a general service car which can be adapted for both construction and maintenance work and which at the same time will be suitable for regular revenue service when not in use in construction or maintenance service. A number of the new type Magor dump cars were recently delivered to the New York Central and the Boston & Maine.

While the new car embodies a number of novel features in dump car design, such as the side and end construction, the principal new feature lies in the operating mechanism of the side doors. Referring to the illustration showing an end view of the car, it will be noted that the door arm is a one-piece casting which is riveted to and forms a part of the car door. This construction relieves the operating mechanism of all stresses set up by any distortion which may occur in the car body itself.

The low height of the car and the design of the dumping mechanism permits its use in either dump car or regular service

At the present time these cars are manufactured with a capacity of 30 cu. yd. They can be dumped to either side. The special valve mechanism permits the dumping of an entire train, a single car, or any number of cars, irrespective of their location in the train. This is accomplished by setting the valve mechanism on each car to suit, the dumping mechanism being controlled by a valve located in the cab of the locomotive.

The general dimensions of the dump car compare favorably with types of open top cars used regularly in revenue service. The body rests directly on the center sill, which gives practically the same load-carrying quali-



Elevation and cross sections of the Magor dump car

ties as a gondola car of standard design, with practically the same height from the rail of the center of gravity when loaded. The general dimensions of the dump car are given in the following table.

Capacity	30 cu. yd., water level
Height above top of rail	7 ft. 9⅞ in.
Width, overall	10 ft. 4 in.
Length, inside of body	34 ft. 6 in.
Depth, inside of body	2 ft. 9 in.
Distance between truck centers	25 ft. 6 in.
Truck wheel base	5 ft. 6 in.
Dumping angle	Approximately 50 deg. from horizontal
Load capacity	100,000 lb.
Approximate weight	61,500 lb.

The doors are opened and closed automatically when the car is dumped by means of control arms of cast steel, one control arm being located opposite each door arm as shown in one of the illustrations. The control arms are pivoted to the car body and are provided with a roller at the outer end which bears against the door arm. The whole mechanism is arranged to cause the doors to open gradually and close when the car is dumped and righted. The opposite door is positively locked automatically during the process of dumping and both doors are positively locked automatically when the car is righted. The doors lie in a plane parallel with the car floor when the car is in the dumping position.

The dumping mechanism is actuated by means of two air-operated pistons in semi-steel cylinders. Two cylinders are located on each side of the car. They are carried in trunnioned bearings on cast steel brackets extending out from the center sill. The piston rod in each cylinder is secured to a cast steel yoke so designed as to compensate for the varying angularity of the cylinder when dumping the car. This yoke is carried in heavy semi-steel bearing boxes bolted to the bottom of the body diaphragm. The bearing boxes have integral body seats which rest on the cylinder trunnion bearings.

Each car is provided with a Westinghouse reservoir secured to the side of the center sill and is supplied with compressed air from a separate train line called the "charging line." This line is of 1¼-in. pipe and is fitted with standard hose and couplings. In addition to the charging line and the regular brake train line, there is an "operating line" which extends the length of the car and is provided with signal hose and coupling.

Automatic control

The dumping mechanism is operated by a three-way valve located near the end sill and can be operated from either side of the car. This valve automatically controls a valve, located near the center of the car, which releases air from the reservoir to the dumping cylinders. The automatic control valve controls the flow of air to either the right-hand or left-hand cylinders. It is fitted with an operating rod provided with handles so arranged as to indicate by their position the setting of the valve. If the handle of the operating control valve rod points upward on the left-hand side of the car it indicates that the valve is set to operate the left-hand cylinders, thus dumping the car to the right side of the track.

With the three-way valve, located near the end sill, in neutral position, the dumping of the cars can be controlled from the locomotive by the flow of air through the operating line direct to the automatic valve, thus following the same sequence as when each car is operated individually by hand. The air brake equipment is independent of all other piping on the car which is an important feature.

Body construction and special equipment

The car body is of all steel construction having an inside length of 34 ft. 6 in. at the top and an inside length of 33 ft. 2 in. at the bottom. The inside width of the car body at the top is 9 ft. 1½ in. and 8 ft. 3½ in. at the bottom.

The inside depth is 2 feet 9 inch. The car has a width overall of 10 ft. 4 in. measured from the outside of the door arms. The underframe has a center sill of fishbelly construction. The draft gear is the Miner A-2-X type. It is equipped with A.R.A. Type D couplers with 6-in. by 8-in. shanks. The trucks have U-section integral box type side frames The wheels are provided with 5½-in. by 10 in. journals, and A.R.A. standards are followed in the construction of the car as far as its special purpose will permit.

Nozzle for spray painting car underframes

In painting cars, the sprayer shown in the illustration has been found handy in reaching remote parts of the underframes, in addition to being light and easily manipulated. It is made of two ½-in. cut-off cocks applied to the end of the paint and air hose. These are joined by a ½-in Y in the end of which is screwed a

A simple nozzle for painting car underframes

short section of a ⅜-in. pipe, flattened at the extreme end to form the spray. A ⅜-in. brass nipple, ground to a point and with a ⅛-in opening is screwed into the air side of the Y, reaching to within ¼ in. of the end of the Y.

A combination five-in-one feed valve wrench designed by I. C. Hurst, air brake foreman, D. & R. G. W. shops at Pueblo, Col.

Master Blacksmiths meet at Buffalo

Interest at convention centered in discussion of use of shape-cutting machines

A TOTAL of 265 members, guests and supply men, were in attendance at the thirty-first annual convention of the International Railroad Master Blacksmiths Association held August 16 to 19 inclusive at the Lafayette Hotel, Buffalo, N. Y. With an actual association membership of practically the same as at this time last year the attendance at this year's convention was an evidence of an increasing appreciation of the importance of this phase of locomotive repair work. The sessions were unusually well attended and the discussion of the various reports indicated a wider interest among a greater proportion of the members in the problems of blacksmith shop work. With the exception of one afternoon when all of those in attendance were the guests of the Master Blacksmiths Supply Men's Association on a trip to Niagara Falls, Ontario, all of the time during the four days was devoted to the presentation and discussion of the following reports; Autogenous welding; carbon and high-speed steel; drop and machine forging; drawbars and drawbar pins; frame making and repairing; heat treatment of iron and steel; reclamation; spring making and repairing; safety work, and tools and formers.

L. C. H. Weidman (C. C. C. & St. L.) President

W. W. Shackford (A. C. L.) First vice-president

J. J. Haggerty (N. Y. C.) Second vice-president

W. J. Mayer (M. C.) Secretary-Treasurer

On the opening day, in connection with the subject of autogenous welding, an interesting paper was presented by W. J. Wiggin, North Billerica, Mass., dealing entirely with the use of the oxygraph shape-cutting machine. Lantern slides were shown illustrating the many uses to which this machine has been adapted by the railroads. Cost and time figures were given on a number of typical railroad shop jobs showing that the savings in costs varied from 18 to 35 per cent through the use of this process. As an example of the time saving element, it was shown that on a certain locomotive frame section it was possible to produce in 3½ hours with the shape-cutting machine a front section which formerly required about three days of blacksmith forging work. Mr. Wiggin's paper created considerable discussion, the greater part of which might be summed up as an expression of skepticism on the

part of some of the older members of the association as to the use of the oxygraph on certain locomotive parts, particularly side and main rods and valve motion parts. The question was as to whether or not the extreme heat generated by the cutting torch has a detrimental effect on the physical structure of modern steels in that portion of the metal adjacent to the cut. Commenting particularly on side rods, several members who have had a great deal of experience with the oxygraph were enthusiastic as to its future possibilities, and these men were in accord on the fact that, provided billets that are to be cut with the oxygraph are preheated to a temperature of approximately 1,250 deg. F. before cutting out and are subsequently annealed, there need be no concern regarding the effect of the cutting temperature. A representative of one road offered the information that in over one and one-half years' experience with rods cut out by this process not a single failure has been reported that might be attributed to the process. An important point was brought out when it was suggested that any road intending to use this machine on rods or motion work should call on the engineer of tests for definite specifications for material and heat treating processes.

The members voted to hold the 1928 convention at Chicago in the hope that this central location would attract more of the far-western members. The following officers were elected to serve for 1928: President, W. H. Shackford, A. C. L., Wayscross, Ga.; first vice-president, J. J. Haggerty, N. Y. C., West Albany, N. Y.; second vice-president, J. P. Reid, Mo. Pac., Kansas City, Mo.; secretary-treasurer, W. J. Mayer, M. C., Detroit, Mich., and chairman of the executive committee, H. D. Wright, P. M., Grand Rapids, Mich.

The following are abstracts of several of the committee reports presented:

Carbon and high speed steel

By W. J. Wiggin
Boston & Maine, No. Billerica, Mass.

Heat treatment of plain carbon tool steel—The hardening temperature of steel is proportional to the carbon content in the ranges of .10-.90 per cent. To harden steel it is necessary to heat it above what is known as its critical temperature. This temperature is the point where the compound formed by the union of carbon and iron, or iron carbide, dissolves in the remaining iron, or ferrite, to form a solid solution known as austentite. It is the retention of this solid solution or phases of this solid solution at ordinary temperature which confers hardness upon the steel.

For best results, tool steel should be normalized before hardening, This places the crystalline structure in the best state to receive the hardening treatment. Naturally the normalizing temperature varies with the carbon content. Steel running .65-80 per cent is heated to 1,475-1,525 deg. F., whereas steels with a higher carbon content of 1.10-1.25 per cent are normalized at 1,575-1,675 deg. F. After complete saturation of the heat the steel is allowed to cool freely in air.

For the normalizing and hardening heats the heating can be done in a lead bath, open furnace, or salt bath. The trend in practically all tool shops is toward the use of special salt baths for the heating operations.

Dry heat furnaces suffer from a lack of uniformity resulting in unevenly heated steel. Easily 50 per cent of the trouble from warping can be laid to unevenly heated steel. Lead baths are objectionable as they are subjected to more temperature fluctuations than salt baths.

Also lead weighs upon the average three or more times as much as a salt bath for the same volume. This increased weight sometimes causes pot bulging and failure. Steel floats upon lead and sinks in salt. Therefore, special means must be employed when using lead to submerge the steel below the surface. This is at times inconvenient. Lead above 1,500 deg. F. fumes readily and the fumes are poisonous.

Lead is readily oxidized by the air at all temperatures, and therefore should be protected from the air by a suitable covering. This oxidation results in the loss of lead and in dirty work. Lead will decarburize the surface of the steel when it contains oxidized lead.

Correct salt baths are free from these defects of lead and dry heat furnaces, and steel quenched from a salt bath is perfectly free from oxidation, presenting a clean finished surface.

Plain carbon steel should be hardened at temperatures ranging from 1,380 to 1,550 deg. F. Naturally, the higher the carbon percentage the lower the hardening temperature. After complete saturation of the heat, the steel is quenched in water at 70 deg. F.

Freshly quenched tool steel is in a condition of strain and subject to easy breakage owing to its brittleness and it should be tempered immediately. It it is only desired to relieve strains, tempering is carried out from 350 to 375 deg. F. For relieving strains and reducing brittleness, temper from 400 to 500 deg. F.

Above 600 deg. F. plain carbon steel will rapidly soften with consequent loss of cutting edge and life of the tool. In fact, drawing at 600 deg. F. causes an approximate loss of 20 per cent in hardness. This loss in some tools is compensated for by the increase in strength and toughness. In tempering, the heating medium should have the largest heat capacity possible so as to obtain uniformity of the tempering effects.

Salt baths have been devised for tempering operations at 350 deg. F. and are rapidly replacing oil and dry heat furnaces. Oil is objectionable above 350 deg. F. as it sludges, gives off objectionable fumes, causes danger of fire, and necessitates the work to be cleaned after drawing.

Dry heat furnaces cause oxidation and are of small capacity. The greatest obstacle of dry heat furnace is temperature non-uniformity. Apoorly drawn tool is defective, as it contains uneven strains.

The selection of the proper quenching oils is of importance, as the securing of the maximum qualities are greatly dependent upon the quenching medium. The oil should be of such character that it extracts the heat from the steel in the most even and uniform manner. This uniform quenching tends to eliminate warpage and the setting up of uneven stresses. The most satisfactory quenching oil will be an entity instead of a blend of different oils, as each individual oil possesses different characteristics. Again, the oil should be of such a nature that it will not oxidize and sludge nor thicken after constant use. Thickening will alter the quenching speed of the oil and result in non-uniform production.

Reheat immediately after quenching to 325 to 400 deg. F. and hold for one hour. Quench from tempering heat in hot water and in oil or air for intricate or small sections.

Heat treatment of high speed steel

The correct heat treatment of high speed steel may be divided into six operations; namely, (1) preheating,

(2) hardening heating, (3) fiirst quench, (4) second quench, (5) drawing, and (6) cooling.

High speed steel is preheated usually to 1,600 deg. F. so that the hardening heating at 2,300 deg. F. can be done rapidly to increase production as well as to obviate the necessity of keeping the steel at the high heat for too great a length of time. It is more beneficial for the steel to bring it up to the high heat by two steps, instead of subjecting the cold steel to the sudden high heat.

The preheating and heating for hardening should be carefully carried out so as to avoid scaling or uneven heating, which causes checking, due to the uneven expansion of the tool. Again, preheating allows all the elements of the steel to enter into solid solution at the same time and thereby eliminates grain growth with the consequent weakening of the tool. After complete saturation at the hardening temperature of 2,300 to 2,400 deg. F. it was formerly the practice to quench by means of an air blast or in oil. The use of an air blast has been avoided as it oxidized the edges, forms pits and impedes subsequent operations. The air blast was replaced with quenching oil, but subsequent research showed that quenching high speed steel in two steps resulted in the most satisfactory tool.

The modern pratcice is to quench from the hardening heat into a quenching bath at 1,075 to 1,175 deg. F. and hold there until the tool reaches the temperature of the bath. This operation eliminates the tendency to warping and cracking without altering the hardness of the steel. As the quenching and drawing of high speed steel are two distinct and separate operations, the steel is removed from the bath at 1,100 deg. F. and allowed to cool freely in air to below 400 deg. F. and replaced immediately in the salt bath at 1,075 to 1,175 deg. F. The steel is held here for a time, ranging from 30 min. to two hours, according to its size; it is then removed and quenched.

It might be argued that the drawback at 1,100 deg. F. could be eliminated by holding th tool at 1,100 deg. F. in the first quench for a longer time. Experiment has shown that such a tool, upon subsequent cooling, will be hardening and not drawn, as the final hardening of high speed steel takes place below 500 deg. F.

Heat treatment of railroad shop tools

To cite an example, the following specifications are those under which various tools are heat treated. It must be kept in mind that these various treatments must be followed out exactly as given, for the slightest variation may and in most cases will lead to poor results. Especially is this true in the case of machine cutting tools where high speed steel is used. In addition, I might add that best results will be obtained if high speed steel receives its hardening heat in a semi-muffle or full muffle furnace, salt baths for the drawing temperature and the type of quenching oil previously mentioned.

SPECIFICATIONS

All tools shall be normalized.

Track tools—Sledges, .70 carbon steel, heat face to 1,450 to 1,500 deg. F. quench in running stream of water.

Picks—70 carbon, heat the ends in lead or salt bath to 1,425 deg. F., quench in water, draw in No. 275 Drawtemp. to 575 deg. F. for 15 minutes and air cool.

Spike mauls—.70 carbon, heat to 1,450 deg. F., quench in water.

Track chisels—Heat bit to 1,650 deg. F., quench in No. 2 soluble quenching oil, draw to about 400 deg. F. in salt bath, cool in air.

Chipping chisels—hand and pneumatic—Heat bit to 1,600 to 1,650 deg. F., quench in No. 2 soluble quenching oil, no draw.

Rivet sets—Heat all over to 1,600 to 1,650 deg. F., quench in oil, draw end of shank to 525 deg. F., or a light purple, let cool in a warm place.

Beading tools—pneumatic—Heat shank to 1,425 deg. F., quench in oil, no draw, then heat bit to 1,600 to 1,650 deg. F., quench in oil, no draw.

Shear blades—First machine, then heat to 1,600 to 1,650 deg. F., quench in No. 2 soluble quenching oil, draw to 425 deg. F., in No. 275 Drawtemp.

Machine tools—Rex "AA" or Mohawk high speed steel, for all of the following tools:

Lathe tools about ¼ inch to ½ inch thick on cutting edge:—preheat to 1,500 to 1,600 deg. F., in a neutral temperature; that is a light flame should be coming out of all openings in the furnace. Otherwise, the surface will be de-carbonized and it will not harden on the outside. Then transfer to a temperature of 2,200 to 2,250 deg. F., and hold for about one and one half minutes, then quench in oil, draw temperature immediately to 1,100 deg. F., for not less than 30 minutes, or longer will not hurt.

Lathe tools ⅝ inch to 1 inch, should be pre-heated as above and under the same condition, transfer to high temperature furnace, which must have a temperature of 2,300 deg. F. Hold at this temperature for 2½ to 3 minutes, quench in oil until the oil is smoking, but not burning, then draw temperature to 1,100 deg. F. in salt or lead bath for one hour, then let cool in a warm place.

Lathe roughing tools, 1¼ inches to 1½ inches by 3 inches:—Pre-heat as above and under same conditions in furnace, transfer to high temperature furnace which must be kept at a temperature of 2,350 deg. F. Hold at this temperature six minutes, quench in oil until the oil smokes but does not burn, then draw in salt or lead baths to 1,100 deg. F. from one to one and one half hours. Let cool slowly.

Milling cutters with fine cutting edge, flue cutters, machine threading dies, taps, etc., should not be heated without using charcoal in the bottom of the furnace. This will stop the cutting edge from de-carbonizing. Pre-heat as above. Small cutters should be pre-heated in a high temperature above 2,200 deg. F. to 2,250 deg. F. and not held longer than one minute, quench in oil until the oil smokes, draw at once to 1,100 deg. F. for not less than 30 minutes in a salt bath.

The large cutters can be heated to 2,300 deg. F. The time required to heat will depend on the size and shape of the teeth or cutting edge. Since it is not desired to harden anything but the cutting edge or teeth, it is not necessary to hold longer than will penetrate the cutting edge of teeth.

Hand punches and mud ring punches:—Normalize at 1,600 deg. F. quench in oil re-heat to about 900 deg. F. or heat the end of punch for about 1½ inches, quench in water, draw to 575 to 600 deg. F. Let cool using Buster Brand tool steel or Seminole hard, normalize at 1,650 deg. F., let cool in oil, re-heat end of punch, draw to 900 deg. F. re-heat to 1,650 deg. F., and quench in oil; no draw.

Tools after being formed to size and desired shape should be placed in a semi-muffle furnace, and normalized. Normalize at a temperature of 1,650 deg. F. This is necessary to relieve strains and stresses set up in forming.

Rex. "AA" high speed steel—Normalize by bringing up to heat slowly and allow the tools to remain at the normalizing temperatures long enough to insure uniform penetration of the heat through the entire tool. After normalizing remove from the furnace and allow to cool slowly in air. Pre-heat slowly and carefully in semi-muffle furnace to 1,550 deg.—1,660 deg. F., then place quickly in high temperature maintained to 2,200 deg. to 2,250 deg. F. This operation is best done with two furnaces, one for pre-heating and one for hardening, both furnaces being of semi or full-muffle construction.

Allow the tool to remain at 2,200 to 2,250 deg. F. for about two to five minutes, depending on the size, and then quench in No. 2 soluble quenching oil, allowing them to cool in the oil to about 300 deg. F.

Tools should then be drawn at 1,100 deg. F. in a salt bath for at least 30 minutes from which they are then removed and cooled slowly in the air, preferably allowing them to lie for a few hours in a warm place such as the top of the heating furnace, which is usually about 200 deg. F., when hot.

Conclusions

These brief and common sense rules will help greatly if they are properly observed:

1—Do not hurry.

2—Do not overheat.

3—Do not try to get uniform heat treatment in a poorly or improperly built furnace.

4—Do not guess. Know correct critical temperature, and be certain to apply that temperature.

5—Do not depend on the eye. Use pyrometers whenever possible—even a magnet is better than nothing.

6—Do not use open forge fires for heat treatment, but always use full or semi-muffle furnace, and liquid salt baths.

7—Do not buy poor steel for good tools. The tool is only as good as the steel from which it is made.

8—Always pre-heat.

9—Avoid any sudden cooling.

10—Final cooling should be given in a warm atmosphere, such as the top of a furnace or similar place about 200 to 300 deg. F. If high speed steel is allowed to remain in a warm temperature the efficiency of the tool will be greatly increased.

11—Never completely cool high speed steel in oil quenching. Tools should be removed from quenching oil when the oil is still smoking, not while the oil is burning.

12—Always draw high speed steel immediately after quenching in oil.

Drop and machine forging

By H. D. Wright

Gen'l. blacksmith foreman, Pere Marquette, Grand Rapids, Mich.

One of the first and most essential features incidental to efficient and maximum production on drop hammers and forging machines, is to study the flow of metal. This is equally true of both iron and steel. Such a study will make possible a decision in the matter of material best suited for dies with which to work it. It answers a twofold purpose, the second having to do with material. Experience has taught me that most railroads are reluctant to purchase material for the manufacture of dies. Disadvantages arising out of this can be greatly remedied through a study of the metal flow. Armed with such knowledge a die sinker can make the most of available material and keep his stock of die making material at a minimum. Some forging machine jobs permit use of a cast iron die; on others billet or driving axle steel will do; but the next job may be of such a nature that the best heat-treated die block steel is none too good. I do not know how many heated arguments I have overheard in connection with adopting a standard steel for die making purposes. Personally I believe the best method is to order such material according to requirements. I have always given a blacksmith foreman credit for having sufficient knowledge of his business to know what material is best for any given die.

Following a study of the metal's flow and a decision as to material from which the die will be made, there remains the designing and manufacture. Many shops have a designer aside from the die sinker, while in others the die sinker serves in both capacities. Whether one man, sufficiently skilled, designs and manufactures the dies, or whether you have a designer in addition to the die sinker, the saving incidental to properly designed and manufactured dies is enormous. The possibilities in this connection were amply demonstrated at the conventions by the Ajax, National and Acme forging machine companies over the past two years. Perfection in die work however, is attainable only through the close collaboration of designer and sinker. Unless a die is properly designed, a die sinker cannot make a job of it, while on the other hand, if a die be properly designed and the die sinker performs sloppy and indifferent work, its value is reduced proportionately.

Drop hammer forging is an entirely different proposition, both as to metal flow and method of die sinking. It is just the reverse from forging machine work in that on the drop hammer stock is reduced while on forging machine it is increased. It is on the drop hammer that good die block steel is needed in 95 per cent of the operations. One of the principal features in connection with drop hammer work is the "breaking down." This is important for two reasons; first, to save stock and second, to save the dies. I have seen flashing from jobs that would equal two-thirds the weight of the forging, whereas four or five blows would have "broken down" the job, saving at least 50 per cent of the weight on material and prolonging the life of the die by five or six times. On a drop hammer improperly handled the waste will offset the saving and render what can and should be an asset either negligible or a liability. In drop hammer forging best results are obtained when the size of the hammer corresponds proportionately to that of the job. Another thing is basing the number of blows in accordance with the character of the work and the dies used.

Frame repairing

By P. T. Curley

Blacksmith foreman, Illinois Central, East St. Louis, Mo.

Cast steel is used in all the new frames of today. How are we going to get the best results with the least time and cost? The majority of railroads cut out the old welds when the engine comes in for general repairs. Between shopping we use both thermit and oxy-acetylene welds and when the engine gets a general repair, we cut the old weld out and make a forge weld, which has proved satisfactory. Failures seldom occur after a forge weld has been made.

We are making bronze welds at the present time, which eventually should prove a success, and result in cutting the time and cost of repairs.

I believe we should insist upon blacksmiths for welding, for they understand the proper heat and working of the metal better than other crafts. Failures, in my opinion, are caused by four things: (1) loose and improper fit binder; (2) welder not getting proper expansion; (3) not keeping frame and welding rods at proper heat, and (4) someone hurrying the weld to get the engine out.

Great care should be exercised in keeping binders tight at all times, and splice bolts well fitted and tight so the frame cannot work and cause unnecessary strain on parts not intended to take the strain.

Forge welds

We have had good results on cast steel frames by cutting about two-thirds the way through the frame and instead of upsetting the frame with sledge and fullers, we cut back about one inch and insert an iron vee ¼ in. by 1 in., which eliminates a great deal of extra work. You can get the vee out and fit the wedge, which is commonly called a "dutchman," at the same heat, which eliminates one heat. Then when you cut the vee from the other side, cut half way through, which leaves about one inch of iron to weld to.

Discussion

In connection with the repairing of locomotive frames, the discussion brought out the fact that some difference of opinion exists as to the advisability of removing

frames and taking them to the blacksmith shop for the purpose of cutting out old autogenous welds and repairing with iron wedge welds. It was suggested that the recent introduction of cast steel frames with integral crossties would complicate matters and make frame removals an expensive operation. The opinion was offered that the proper application of thermit welding would obviate the necessity of removing frames and result in a better job on cast steel frames than could be made by iron welds in the smith shop.

Tools and formers

By G. W. Grady

Blacksmith foreman, C. & N. W., Chicago

The first thing when an order for certain forgings is received, is to see if you cannot make a die or former so that you can make them faster than over an anvil. I want to offer photographs of some forgings which we make at the C. & N. W. shops at Chicago. These explain the various operations:

Fig. 1—*Link pin for a trailer spring.*—This is made out of 3-in. round wrought iron. Three upsets are required for gathering the stock, by moving the material forward in the die approximately 4 in. at each upset. Another heat is required at this time to complete the forging, the flange of which, when finished, is 7 in. square by 1⅛ in. thick. Ten forgings are made in eight hours by one blacksmith, one heater and one helper.

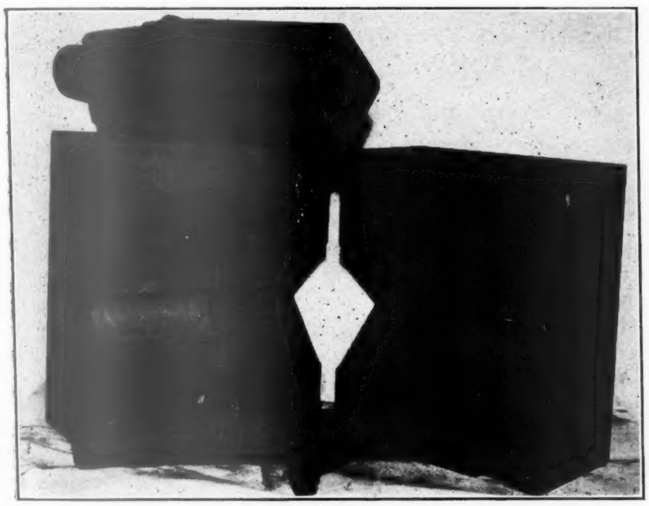


Fig. 1—Formers for trailer spring link pin

Fig. 2—*Valve stem forging.*—Manufactured out of 2½-in. round soft steel and made in one operation, the collar of the valve stem being 1 in. thick by 4½ in. diameter. The header is bored 2⅝-inch. diameter, deep enough to admit the stock, to where the collar is to be formed on the valve stem, and where the heat is taken on the material. The stock is gripped in dies and held from slipping back, in connection with a back stop. The opposite end of stock is entered into the hole of the header, and as this makes its forward stroke the stock comes in contact at the bottom of the hole in the header, upsetting the material and forming the collar. Twenty valve stems are made in eight hours by one blacksmith, one heater and one helper which is a good production for so few men.

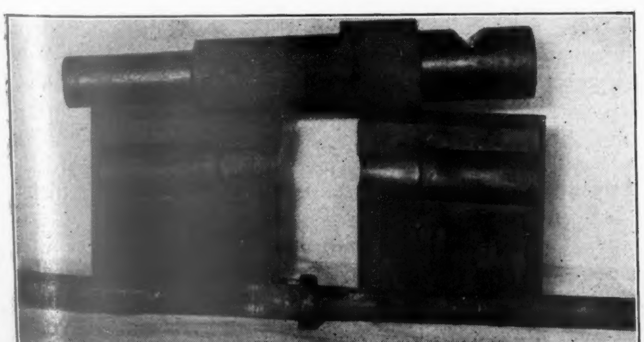


Fig. 2—Dies for forging valve stems

Fig. 3—*Drawbar pin.*—Manufactured out of 3¾ in. round engine bolt iron and made in one operation. Dimensions of finished pin are 4 in. diameter by 17 in. long. Stock is cut to proper length to allow for upset of head and body of pin. It is headed and pointed at the same operation. Eighty of these pins are made in eight hours with one blacksmith, one heater and one helper.

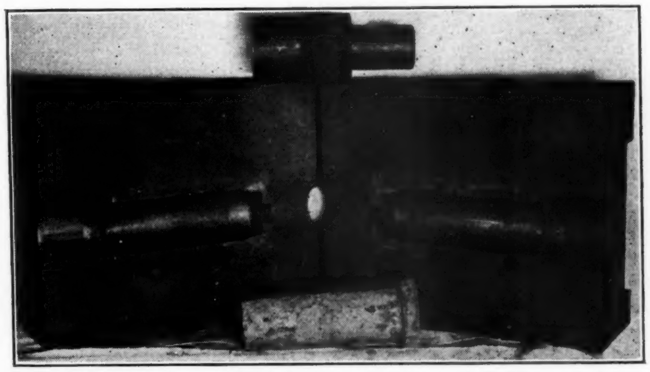


Fig. 3—Dies for making drawbar pins

Fig. 4—*Trailer truck spring hanger.*—Manufactured out of 1 in. by 2½ in. round iron. Material is bent double 7 in. long at one end. Material is swedged (under auxiliary press) back of double material to 2-in. diameter and 6 in. long. This stock is applied to first die operation where ball is formed and part of the slotted end. Two pieces of ¾-in. by 2½-in. iron are placed on each side of the partly formed slotted end and welded. To form the top end of the hanger a piece of 2½ in. square iron is placed between the jaw and welded. The slot is punched on another machine.

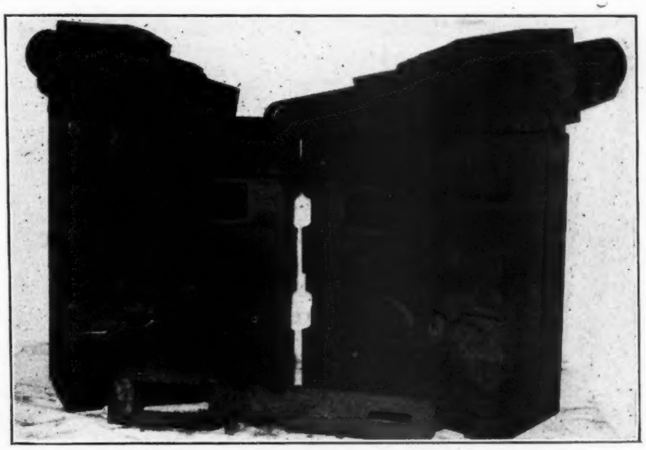


Fig. 4—Trailer truck spring hanger dies

Eight are made in eight hours, with one blacksmith, one heater and one helper.

Spring making and repairing

By J. J. Eagan

Foreman blacksmith, N. Y. N. H. & H., New Haven, Conn.

The problem has presented itself to us as one of taking the present A.R.A. specifications for spring steel and processing and heat treating them in such a way as to obtain the maximum results possible.

This is discussed under four factors: namely, (1) steel, (2) temperature effect on steel, (3) quenching media, and (4) tempering or drawing.

After exhaustive research it has been found that with the present spring steel, in order to get the maximum results possible and get a spring which has the most desirable characteristics, it is necessary that all four factors be involved in the heat treatment of the spring.

Quenching in oil develops a very high tensile strength with very low elongation and reduction of area. Leaving a spring in such a condition, it will have the maximum of brittleness and the least amount of resiliency. In other words, a spring with such characteristics would fracture under a sudden load or in constant operation assume a permanent stretch and would be of no more value than a block of steel.

In the tempering operation, while we sacrifice to a small extent some of the tensile strength, we increase the value of the elongation and reduction of area. That is, the ductility and resiliency of the spring is increased to a large degree.

However, in tempering, it is necessary that the right temperature be used in order to give a maximum of these desirable properties. Therefore, it is necessary to use a heating medium which will be susceptible to the least amount of temperature variation and which will be uniform throughout its whole mass.

We believe you will agree with us that it is absolutely necessary for a drawing operation, in that the drawing operation increases the per cent elongation over 50 per cent above the former standard methods of heat treating springs.

Below we quote the physical characteristics you should obtain in your spring steel when properly heat treated:

Tensile strength..	218,000 lb. per sq. in.	Reduction of area..	16 per cent
Elongation.......	10½ per cent in 2 in.	Brinell hardness....	385-415

It has been conclusively proved and admitted by the leading metallurgists of the country that the uniform drawing temperature can only be obtained in a salt bath, in that open furnace drawing operations, no matter how well constructed the furnace, are subject to variations of temperature as well as the other defects of scaling, oxidation, etc.

The figures are a revelation when it is remembered that tensile strength measures resistance to permanent set and per cent elongation measures resistance to fracture. In fact, we increase the tensile strength from 188,000 lb. per sq. in. as that obtained by the present railroad and manufacturers' practice to 218,000 lb. per sq. in.

Also the elongation in two inches is increased from 5 per cent, as obtained by the present railroads and manufacturers' practice, to 10 per cent, in other words, an increase of 100 per cent.

For years spring manufacturers have taken advantage of the ignorance of the user to the extent that they have foisted upon railroads, springs of such character as do not give the maximum life of service. Spring failure has been definitely attributed to the lack of proper supervision of the heat treating phase of this work. Spring failure is now caused by either fracture or from permanent set. Springs properly processed should never take permanent set in service. The only cause for failure is permanent set caused alone by fatigue.

The losses of springs at the present time, caused by fracture, are not due to fatigue stresses but directly to the application of too high and uncontrolled temperatures to springs in the course of manufacture. The loss attributed directly to spring failures has a far-reaching effect.

Springs as now manufactured are springs in name only. There is very little actual spring action in the present springs and it acts in no small measure as a solid block supporting the load it is to carry. This results in spring fractures and general wear and tear on equipment, a great amount of which could be eliminated with springs of such character as would actually render a real spring action.

Springs can be manufactured in the railroad shops at different points at a cost far below the prices now paid spring manufacturers for inefficient springs, and if manufactured with the proper engineering supervision will show increased life over present springs now purchased, of at least 30 per cent. In time this effects a reduction in maintenance and operating costs of 30 per cent on work which is now attributable to spring failures.

Coil springs as now purchased from the manufacturer have but a comparatively short life in service until permanent set develops. This condition necessitates frequent removals of the coil type springs.

Coil springs can be reclaimed with a small capital investment and at a cost which will effect large economies over the present contract prices now existing with spring manufacturers for work of this character. Aside from this economy, increase in the efficiency of the springs can be produced, insuring longer life in service. There will also be a reduction in operating costs, which is now necessary due to frequent removals of coil springs.

Uniform shaping, which is difficult in hand work, is possible when springs are made with the proper type mechanical equipment. More uniform, reliable and durable springs reduce the frequency of failure.

Description of operations

The following is a description of operations of the practice followed by most progressive roads, although operations such as tapering and punching may be carried on before nibbing and trimming without any effect in the cost or output, the important fact being to keep the operations, as they are laid out, in proper sequence.

Stripping.—Stripping of the bands is performed with a hydraulic spring stripping machine, saving considerable time over other methods and permitting the re-use of a large percentage of the old bands.

After the bands have been removed the broken leaves are discarded and new leaves worked up for replacement.

Shearing.—Shearing new spring steel bar stock to length can be accomplished on a combined shearing and hot punching machine. After cutting to length the bars are passed to the top of adjacent furnace and heated in the middle for the nibbing operation. Stock should be conveniently placed near this equipment.

Nibbing.—Nibbing or beading of the new leaves is done on a nibbing and trimming machine, the universal gage insuring an equal distance from the point of the nib to the ends of the leaf. After nibbing, the leaves are returned to the same furnace for heating the ends prior to hot punching or tapering.

Punching.—After heating, punching for inside hangers or notching for outside hangers, is done on the punch end of the shearing and necessary hot punching equipment.

Tapering.—The new spring leaves are tapered on a tapering and swedging machine. The leaves are heated on one end and put through the machine. The operation is repeated for the opposite ends of the leaves. In case any of the tapered plates have hanger slots or notches, they are immediately returned to the punching equipment and punched at the same heat for tapering. This is done to eliminate another heat.

Trimming.—Coming from the taper roll, or hot punch, the spring leaves are trimmed on the trimming side of the nibber and trimmer; the nib fitting over the gage point serves as a pivot on which to trim successively one end and then the other. The old spring leaves (from springs being repaired) and the new leaves are now brought together, the old leaves coming immediately from the stripper to the side of the forming machine. The new leaves are now assembled in their proper sequence ready to be fitted, hardened and drawn, banded and tested. The last operation being the means of partially determining length of life in service of assembled spring.

Forming.—With proper equipment new leaves can be correctly formed and the desired camber produced at one time. Any twist that may be in the steel is eliminated by using this power forming equipment. Equipment of this character is universal, because the machine will receive leaves of any radius, length, width or thickness within the capacity of the machine. There is very little loss of temperature between the time of removal from the furnace to the completion of the forming operations prior to entering the required quenching medium.

It is very important to note that it is necessary to leave sufficient spacing in the fitting operation with the longer auxiliary leaves. This is to allow for stress development in the banding operation.

Where leaves are closely fitted on the banding operation tremendous stress is developed in the shorter leaves, causing frequent failure in service.

The bands should have a half-inch radius at point of contact with the leaves—this eliminates a tendency of a shearing action where a 45 deg. angle is used. Design in no small measure determines the life of springs in service.

Assembling.—Assembling of the spring leaves is done efficiently on a spring assembling table. The springs are laid on the assembling table, clamped by a cylinder plunger, tilted to a vertical position and a hot band slipped in place. After tipping down again on the table the spring is then pushed into the banding press for the next operation.

Banding.—Banding is done on the banding press and after the spring with a hot band is introduced into the press, pressure is applied and the band is set. Banding presses are usually of the hydraulic pressure type and are recommended where possible, owing to the extreme importance of having bands applied under sufficient pressure to keep the spring leaves tight and maintain their alinement.

Testing.—Springs are then ready for the testing operation. There are quite a few testing machines suitable for this operation. Springs are given several applications of pressure and are checked up for deflection and permanent set under load. To test locomotive and car springs requires just as great accuracy and reliability as the test of an automobile or truck spring.

Drawbars and drawbar pins

By E. Hall

Foreman blacksmith, T. & P., Marshall, Tex.

On the Texas & Pacific, drawbars, safety bars, safety chains and pins are made of the best quality refined hammered wrought iron having a tensile strength of not less than 45,000 lb. per sq. in.; all parts are forged in one piece and, with the exception of safety chains, no welds being permitted. Drawbars, when conditions will permit must be straight throughout their full length, the use of offset bars to be eliminated as far as possible. The practice of offsetting drawbars for convenience in changing locomotive tenders will not be permitted. Sharp or short bends must be eliminated. When new drawbars are made, in heating for forging or upsetting they must be cooled slowly and not quenched in water or thrown on damp ground. Pin holes in drawbars and safety bars are to be drilled when the metal is cold; under no circumstances are the holes to be punched thus, eliminating tearing of the hole.

Drawbars, safety bars and pins are to be thoroughly annealed every six months and closely inspected for defects after annealing. This inspection at the time of annealing serves as one of the required Federal inspections. Each drawbar must be stenciled showing the date and the initials of the shop where made. The stenciled date and station initial shall be placed on the top face of the bar near the tender end. All drawbars and connections must be inspected without removal at the end of each trip.

Any drawbars that are too long may be upset to reduce the length at any point which is at least 12 in. from any previous point of upsetting, care being taken that they are cooled off gradually. Drawbars which have pin holes that are worn too large, if not over 1/4 in. larger than specified diameter, may be closed up provided there is sufficient material at the end of the bar to give a full-dimensioned section.

Under no circumstances are drawbars to be banded at the ends or drawn out in such a manner as to reduce the section to smaller than specified dimensions. The rough ridges of metal left around the pin hole should be cut off by chisel before the bars are placed in service. All bolts in safety chain connections are securely fastened with a nut and steel split key or cotter pin. Draw castings on locomotives and tenders are inspected at each regular drawbar inspection. At each general shopping the draw castings on locomotive and tender are to be given as thorough an inspection as can be made without the removal of the castings. A thorough inspection shall also be made of all tender framing bracing, bolts and rivets at the front end of the locomotive tender.

When the sills, corner angles, braces, etc., are found to be corroded to the extent of impairing their strength, or to be cracked or defective, these parts must be reinforced. Undersized bolts must be replaced. Drawbar and safety bar pockets must be examined at the time of the quarterly inspection. Bolts or rivets securing castings to be properly maintained. The clearances in the pocket above the drawbar or safety bar are to be not less than 3/4 in. nor more than 1 1/2 in.; 1 in. is preferable. There should also be ample clearance in the pockets around the sides and ends of the bars to prevent the bars from binding when the locomotive is passing through curves, and a minimum clearance of 2 in. is to be maintained. All parts of drawbars and connections are to have ample clearance and not to interfere or bear against any of the engine or tender castings. The edges

of holes are to be filed to eliminate any sharp edges that may remain.

Discussion

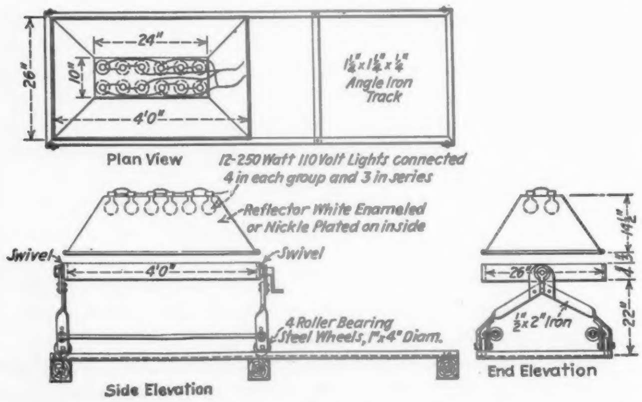
On the subject of drawbars there was considerable discussion as to the relative merits of handling billets for this work by hammering, rolling, or by the use of hydraulic presses. It was pointed out that in billets which are poured on end at the steel mill a pipe or cavity in the center many times results. In working up such billets the hammering process produces a drawbar of much finer grain structure, but will not eliminate the danger of failure due to a hidden cavity. The rolling process many times only serves to elongate the cavity. Some roads have overcome this difficulty by using billets of sufficient length to make two drawbars; then when the billet is cut in two at the center any existing cavity can be discovered.

Electric blue printing machine

By H. H. Henson
Machine shop foreman, Southern, Chattanooga, Tenn.

THERE are many small railroad shops that do not have a sufficient amount of blue prints to make to justify the purchase of an expensive machine for this purpose. As a result, many of these shops are using the old method of the sun light exposure which requires considerable time and is uncertain in results. The illustration shows the construction of a blue printing machine that will take care of any print handled in ordinary shop practice.

The frame is 26 in. wide by 4 ft. long and 4 in. deep, made of seasoned timber, preferably ash, that will not warp from the intense heat set up by the electric bulbs. The bottom is made of plate glass. The frame is mounted on four roller-bearing steel wheels which travel over a 1¼ in. by 1¼ by ¼-in. by 9 ft. angle track held together by ⅜ in. rivets. This arrangement allows the frame to be pushed under the reflector. A swivel is



Details of an electric blue printing machine for use in the small shop

provided on the frame so that it can be turned over to remove the print or turned in any convenient position to suit the operator. The back is made of hinged boards with springs attached to them which press the printing paper down on the tracing and glass the same as in the sun printing frames. The reflector is made of medium gage galvanized iron, either nickel plated or enameled white on the inside. A nickel finish is preferable as it will better stand the heat than enamel, which tends to crack. The reflector is fastened to the frame.

The light is furnished by 12 250-watt 110-volt lights, three in each of four groups connected in series. This combination will give a 3,000-candlepower light, by which one print a minute can be made.

The total cost of building a machine of this kind is about $75.

Portable tank for washing air compressors

By I. C. Hurst
Air brake foreman, D. & R. G. W., Pueblo, Col.

THE portable tank for washing air compressors shown in the illustration, will hold ten gallons of solution but ordinarily is used about half full, with from seven to ten cans of lye in the solution. A small jet of steam is allowed to enter the lye solution through the hose at the top of the tank. The two valves shown near the top are three-way valves salvaged from

A portable tank for washing air compressors controlled by two three-way valves salvaged from dismantled cars

dismantled cars. On the inside of the tank and connected with the valve shown on the right is a pipe which extends to within 2 in. of the bottom. The action of the air compressor, in operation, sucks the lye solution out of the tank, and returns it to the tank through the valve on the left. The discharge pipe connected with this valve extends horizontally across the interior of the tank and is slotted for about 5 or 6 in. at the bottom. To discharge the solution from the end of the pipe causes too much boiling of the hot solution. By turning the three way valves and connecting a hose from one of them with the water main and a hose from the other with the sewer, a stream of clean water can be substituted almost instantly. A set of connections are available for washing compound compressors, or two compressors at the same time, if the engine is so equipped. All of the hose is of sufficient length so that the device can be operated from either side of the locomotive.

Shoes and wedges up—Locomotive ready to wheel

Handling the shoe and wedge job

A description of methods used in applying and maintaining shoes and wedges in the back shop of a western railroad

By A. J. Pert

THE majority of the readers of the *Railway Mechanical Engineer* are familiar with the work of fitting up the binders, smoothing up the frame, placing liners in the shoes and wedges, and the rest of the preliminary work for laying out a set of shoes and wedges. The binders should fit the jaws and have some draw or space between the binder and

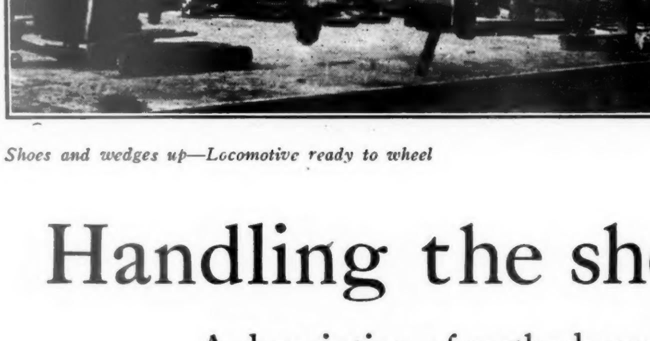


Fig. 1—Method of drawing the horizontal base line over the jaws

frame when the former is driven tightly in place. From 1/8 in. to 1/4 in. is enough. The wedge should be blocked up 3/4 in. off the binder so it will go up to near this position after the work is completed. A spreader should be used between each shoe and wedge to hold them tightly against the frame pedestals. In the absence of special spreaders made for this purpose, good spreaders may be made by slipping pipe nipples over 1-in. bolts. The bolt is somewhat shorter than the space between the shoe and wedge, and running out the nut against the pipe gives the required spreading action.

Railroad mechanics are usually familiar with several methods of laying off shoes and wedges. The first consideration is to establish a square line across the frames from which the axles are located so they will be at right angles to the frame. The different methods for locating this square line constitute the principal difference in the methods of laying out shoes and wedges. The first step is a preliminary location of the main axle centers. The main axle centers must be such a distance back from the cylinders that, with parts of standard dimensions, the piston clearance will be divided properly—nearly equal front and back. This matter of clearance is of special importance on locomotives with alloy steel main rods, which, on account of previous heat treatment, cannot be altered in the blacksmith shop, and which, due to the solid back end of the main rod with a floating bushing, cannot be changed like the strap type rods by changing the liners around. Some rods even have bushings in the front end of the main rod so there is no opportunity to change the length.

One method of roughly locating the main wheel centers is to measure back from the cylinder fit on the frame. The distance from the shoulder on the frame where the back of the cylinder rests to the main wheel centers is usually shown on the drawings. This is a method, good and simple, if the drawings showing this distance back are available. More than likely, however, there are no such drawings at hand. To get a preliminary location of the main wheel centers, the main shoe faces are carried up on the back side of the frame, using a flexible scale *C* to draw the line *DE* as shown in Fig. 1. The main jaw is calipered at the top and half this distance is measured back from the extended shoe face line. There may be considerable difference in the size across the top of the jaw on opposite

sides of the locomotive so that the distance measured back from the shoe face is not necessarily the same on opposite sides. In using this last method to locate preliminary centers it is assumed that the frame is made approximately to the builder's drawings and that, if the main wheels are nearly central with the top of the main jaws, the main rod length will come out all right.

Before any of the actual layout operations, a line is drawn near the middle of the frame by the use of a pair of hermaphrodite calipers *B* and a parallel strip *A*. This line is drawn over each jaw on the outside and over the main jaw on both the inside and outside.

Squaring the frame

The older methods used in squaring the frame will be considered first. A method described in early locomotive repair books, a variation of which is still in use, is tramming back from the center casting with a fish trail tram. The round boss on the center casting (usually found on the American type and other early types of locomotives), is assumed to be truly round and central between the frames. The forked end of the tram is placed against the center casting referring to Fig. 2 and the adjustable tram point is set to fall in one of the preliminary centers *C-C* located as just described. Let us assume, the center on the right side. The tram is tried on the left side of the frame and will probably not fall in the preliminary center on this side, but a short distance from it. An adjustment of the length of the tram is then made so that it will fall as much behind the preliminary center *C* on one side as it falls ahead of it on the other side. The preliminary centers *C-C* are now rubbed out, the frame having previously been chalked or whitewashed, and new centers established where the tram point crosses the horizontal base line. These centers are projected to the top of the frame using a parallel strip and combination square, and lightly prick punched. A short straight edge is now placed across both frames even with the prick punch marks, and a line drawn 90 deg. to the center line of the frame across the top of both frames, and extended to the outside of the frame using the combination square

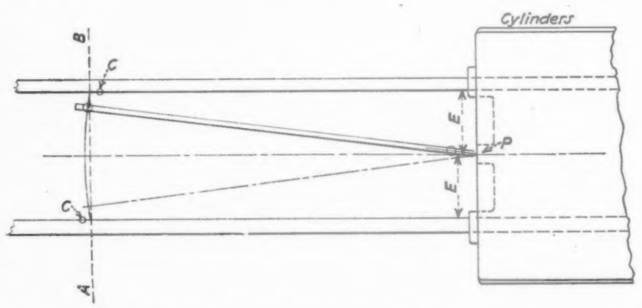


Fig. 2—Method of establishing the line *AB* by tramming from the point *P*

and parallel strip. The geometrical method of proof is given in Fig. 3, although this is hardly necessary as it is self-evident that a line laid out in this manner from a central point near the front of the frame will be at 90 deg. to the frame. A modern adaptation of this method is still in common use. Instead of a fish tail tram, a swivel joint tram on a stick is used. One end is turned parallel to the stick and this is placed in a center punch mark on the cylinder saddle equidistant from the frames. The operation of tramming back and establishing at 90 deg. to the frame a line above the location of the main wheel center is the same as just described.

This method is satisfactory on the older types of locomotives which do not have many cross braces between the frames, but on modern power it is not satisfactory on account of the numerous cross members. While on a recent visit to a lumber camp shop which maintains about twelve locomotives the writer noticed this method in use. In this instance a board was fitted between the frames just back of the cylinders and the center located here. On balanced compounds the center may be located on the guide yoke. The guide yoke extends across the frames on this type in such a way that a tram from the cylinders cannot be used.

The variations of this method are open to the criticism that the axles are squared to an imaginary center

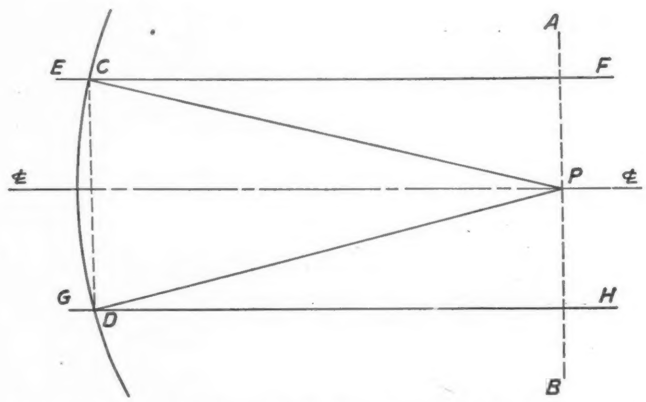


Fig. 3—Geometrical proof that the line *CD* is at 90 deg. with *EF* and *GH*—The point *P* on the line *AB* is equidistant between the frames

line between the frames, rather than to the driving wheel base, or to the frames themselves. There is another method of squaring the frame that was once much used. In this method, the frames were squared to the cylinder center lines using a line through both cylinders and a straight edge blocked up across the main jaws in the preliminary location of the wheel centers. The straight edge was actually squared to the cylinder center lines, using a large frame square. The straight edge was moved to be as near square as possible to both lines at the same time keeping it as far ahead of the preliminary center on one side as it was in the rear on the other side. Thus, the proper average distance back was maintained. The criticism of this method is that the cylinder bore is seldom exactly parallel to the frame and also the fact that the two cylinder bores may not be exactly parallel. A very slight error amounts to considerable by the time the center line is extended back as far as the main wheels.

Probably the most satisfactory way to square the frame is to establish a line, at 90 degrees to the driving wheel base by the use of straight edges. The driving wheel base to consider is the distance from the center of the front driving axle to the center of the back driving axle. To draw a line at 90 deg. with this wheel base, a long straight edge is clamped to the frame, central with the driving wheel base and with a parallel strip at each end. The longest straight edge is clamped central with the driving wheel base. (The main wheels may or may not be in the middle of the driving wheel base.) A shorter straight edge, hereafter called the transverse straight edge, is placed across the frames and lined up to the preliminary main wheel centers which have been located by measuring back from the cylinder frame fit as shown in the drawings. The transverse straight edge is squared to the long straight edge by the use of the frame square. The long straight

edge may then be clamped to the other side of the frame, or two long straight edges used on each side, and the frame square used on this side to see if it is also square. If not, a compromise must be made, setting the transverse straight edge as nearly as possible 90 deg. to both frames and maintaining the proper average distance back from the cylinder fit. After the transverse straight edge has been set square it is an easy matter to bring the line down on the outside of the frame with a combination square and parallel strip. The point where the line intersects the horizontal base line is pricked punched

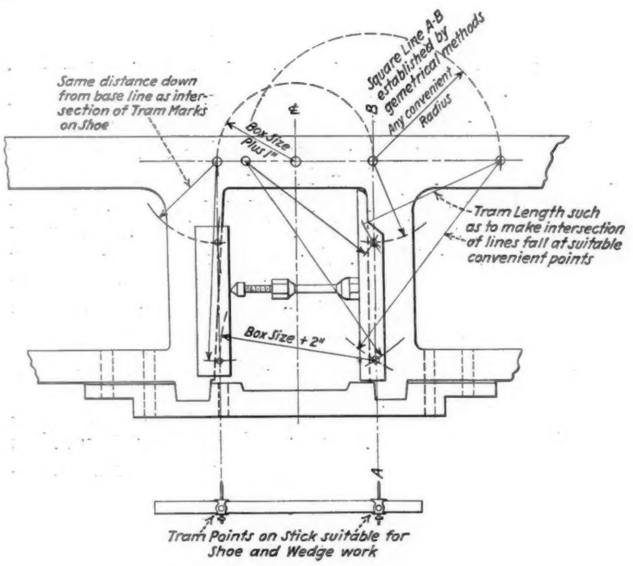


Fig. 4—Method of transferring the "one-half the box size plus one inch" mark to the main shoe

and marked with a "bird's eye," and represents the vertical extension of the location of the main wheel center.

The methods of handling the laying out from here on are very similar, and a good method is shown in Fig. 4. The size of all the driving boxes across the shoe and wedge face is noted. Starting at the right main jaw to place the layout marks on the shoe and wedge, the adjustable tram points are set ½ the box size plus one inch, and this dimension laid out both ways from the main center. The points where these two lines cross the horizontal base line are lightly prick punched. These two points are projected down on the shoe and wedge flanges respectively, either by the use of a frame square and parallel strip, or by the geometrical method of squaring a line as shown in Fig. 4. The tram is set to the rod length and the centers locating the front, back, and intermediate wheels are located on the frame. One-half of each box size plus one inch is laid out both ways from the center over each respective jaw. In order that the marks on all the shoes and wedges will be the same distance down from the base line, tram marks are made on all of them, measuring down from the box size plus the one inch marks. One mark is then near the top of each wedge and another near the bottom of each, the same distance down as the marks already made on the main jaws. The same distance down from the base line is used in marking the shoes.

The shoes and wedges are also marked in this manner on the inside flange, but one mark—the lower one—is sufficient, as one mark on the inside flange of each shoe and wedge is all that is used. The long tram is used to project the one-half box size plus the one inch marks down on the front, back, and intermediate shoes and wedges as shown. One inch is added to one-half the box size in laying out, so that the shoes and wedges may be planed to within one inch of this mark, leaving the prick punch mark for a proof mark. By the use of the one inch gage shown in Fig. 5 it is a very easy matter to check up the shoes and wedges to see if they have been correctly planed. If the actual line to which the shoes and wedges were planed were laid off on the flanges it would be removed entirely in planing the fillet, and there would be no proof mark by which to check the planing operation.

To place the inside mark on the main shoes, a straight edge is blocked up across the main jaws resting against the shoes, and as high up as the lower outside marks. A pair of hermaphrodite calipers is used to set this straight edge equidistant from the marks on the outside flanges of the right and left shoe. With the hermaphrodite set to this dimension, the inside flanges of the shoes are marked, measuring from the face of the straight edge. To mark the wedges, the tram is set box size plus two inches, see Fig. 6, and the inside flange of the wedge is marked, tramming from the mark just made on the inside of the shoe. To place the mark on the inside flanges of the back, front and intermediate shoes and wedges, the long tram is used, setting it to the corresponding centers on the outside of the flanges and then tramming the inside flanges, where possible, always tramming from the marks on the main jaws. Three points determine a surface, therefore three points on a shoe or wedge are sufficient to set it up for planing and one mark, in addition to the two on the outside, on each inside flange is enough.

The front, back and intermediate shoes and wedges should be squared down by the use of the long tram as shown, and not by the use of the frame square or other method as used in squaring down the main boxes. It is essential that the exact proper distance between the adjacent wheels be maintained so that the rods will go on and pass over the dead centers freely. By the use of the long tram in laying out the front, back and intermediate shoes and wedges, there is little chance for any error in rod length to creep in.

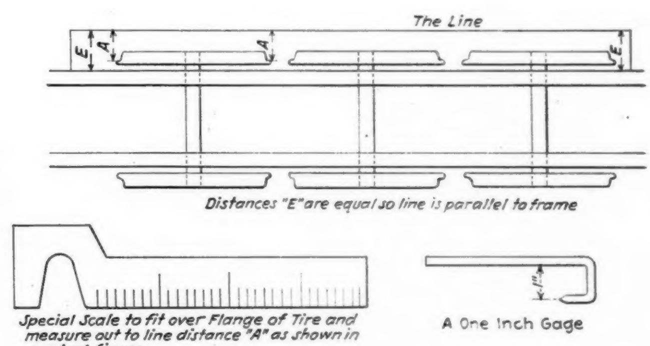


Fig. 5—Method of checking wheels to determine if square with the frame

Method of wheeling a locomotive

If the boxes are bored out of center more than 1/32 in. or at most 1/16 in., it is necessary to throw the center on the frame to overcome this error in the box. It should be moved about two-thirds the amount of error, for the axle center produced by a change in the center on the frame is somewhat more than the actual amount the center is moved. If both sides are thrown the same amount in the same direction this does not apply, and

the centers should be moved the amount the boxes are out.

A method of wheeling is used in the locomotive builders and in some of the larger railroad shops that might be adopted by all shops to advantage. The shoes are secured in place on the pedestal jaw by a set screw in the upper inside corner of the shoes. The wedges are held in place supported by a U-shaped clamp cut out of ¼-in. plate and held between two nuts on the binder bolt. This clamp holds the wedge six or more inches below its normal position so that when the engine is lowered on the wheels the boxes will enter properly between the shoe and wedge. A small fillet is cut around the bottom of the flanges of the driving boxes, so that, as the engine is lowered on the wheels the shoes and wedges will start in the box readily. A wire is placed around the wedge and the frame to keep the wedge from falling off the clamp. This wire may be cut and pulled out after the engine is wheeled. This method by which the locomotive is lowered on the wheels with the shoes and wedges in place saves a good deal of hard labor putting up the shoes and wedges after it is wheeled.

Lateral

The lateral across the frames is taken by measuring across the outside flanges of the shoes and wedges in several places while the latter are in place. A smooth stick may be placed across the jaws and the size across the frames including both flanges may be scribed on the stick, using a scale. A scale or straight edge is held flush on one side while the lateral dimension is scribed on the other side. The distance across the inside of the wheel hubs is then measured with an adjustable inside tram. The tram is placed with one end flush with the end of the stick used to take the frame lateral and the difference between the distance between the hubs and the lateral across the frames including the flanges is noted. One-half this, minus the one-half total lateral motion allowed is the size given the machine side so that the lateral on the outside face of the boxes may be properly machined. If one hub

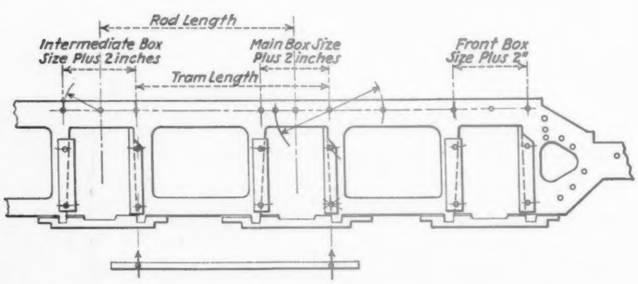


Fig. 6—Method of marking the "box size plus the two-inch marks" on the front, back and intermediate shoes by using a long tram from the main wedge

of a pair of wheels should be faced thin or the wheel machined so that the wheel rims are not the same distance from the inside hub face, this would cause the wheel tread to be out of line sideways with the other wheels. To catch an error of this kind, a straight edge is placed across the rim of the wheel and the distance from the inside hub face to the straight edge (outer rim of the wheel) is calipered through the spokes. The operation is repeated on the opposite side and the dimensions should be the same. If not, the lateral on the right and left boxes are changed so that the wheel treads will be central with the frame.

Wheels should be checked in this manner before the hub liners are applied and the liners put on in such a way as to keep the wheels central. The amount of lateral to allow on a pair of wheels varies. One-eighth inch total lateral, 1/16 in., on each box, is about the least lateral allowed. The lateral allowed on the front and back wheels is more than on the main wheels, about 3/16 in. The lateral allowed on trucks and trailers is more, sometimes as much as ¼ in. A certain amount of lateral is necessary to enable the locomotive to pass freely around curves. The exact amount of lateral to allow on each pair of wheels on every different class of locomotive is often shown on the company blueprints.

Cut flanges

If the shoes and wedges have not been laid off square with the driving wheel base, cut flanges will develop. It is natural for the flanges of the front pair of wheels to wear out first for these flanges guide the locomotive around the curves. It is a hard matter, to correct in the engine house, a defect causing cut flanges. Sometimes all the wheels on the side cutting are thrown ahead 1/16 in. or ⅛ in., the exact amount necessary left to the judgment of the mechanic. If one flange is cutting, this tire may be set in a little. It is also sometimes possible to correct the defect causing cut flanges by a change in the three point hangers of the engine truck, which will keep the locomotive from crowding one side. This method which has been previously described in the *Railway Mechanical Engineer** consists in building up one side of the three point members so as to crowd the bolster to one side.

There is also another simple method of trying the flanges to see if the wheels are square with the frame. Referring to Fig. 5, a string is extended along the frame and set equidistant from it by measuring out from the frame to the string near the ends of the driving wheel base. A *special scale* is provided with an end shaped to fit the contour of the flange so the distance from the flange to the string in front and back of the center of all the wheels may be measured. On any given pair of wheels, the distance from the flange to the string should be the same ahead or back of the wheel center. If out, usually all the wheels will show out the same amount and they must all be thrown by a change in the shoes and wedges to square them up. This operation of throwing a set of wheels is a rather disagreeable job and should be avoided by careful laying out in the first place.

Counterbalancing

It is often difficult to obtain accurate information on counterbalancing. The method used is to place the wheels on balancing strips, usually a pair of level metal horses with a rather thin edge, about ⅜ in. wide, supporting the wheels at the journals. The wheels are free to turn on these strips when the weight is added to one side of the rim, or a weight if hung from the crankpin. The wheels are balanced against a certain predetermined weight which is hung from the crankpin. Lead is poured in the counterweight cavity until the wheels balance. A table of the proper weights to hang from the crankpins of different wheels on the different classes of locomotive is often furnished by the railroad company.

There are also formulas by which the proper weight against which the wheels are balanced may be obtained. One formula is to balance all the revolving weight and one-third of the reciprocating weight distributed equally among all the wheels. The revolving weight is the weight of the end of the side rod that passes over the

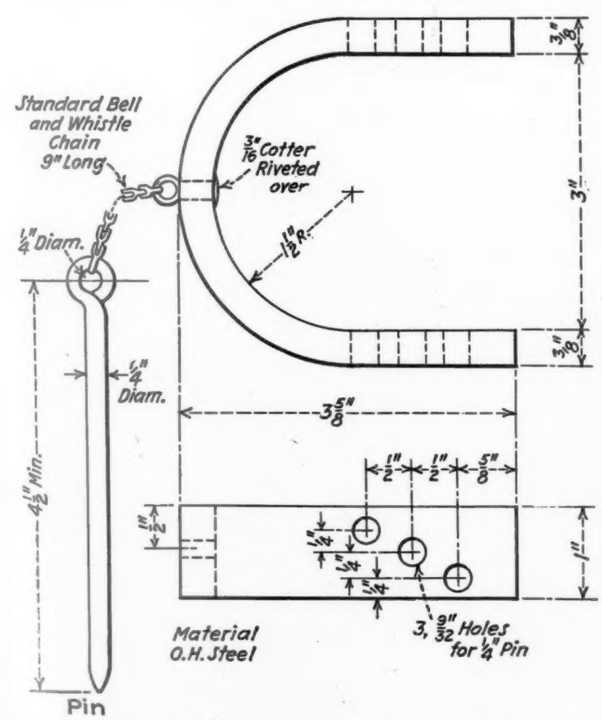
* December, 1926, *Railway Mechanical Engineer*, p. 768.

pin and in the case of the main wheels, the weight of the back end of the main rod also. To obtain these weights the rods should be supported by thin knife edge supports. One should be placed on the scales and the end of the rod to be weighed rested on this support with the center of the rod bushing directly over the support. The opposite end of the rod should be supported in a similar manner in such a way that the rod will be level. The reciprocating weight includes the weight of the piston, crosshead and the front end of the main rod. One-third of the weight is taken and divided by the number of wheels. The revolving weight plus this amount is the weight to hang from each crankpin against which the wheels are balanced by pouring lead in the space provided near the rim opposite the crankpin. These cranks should be in place in balancing when balancing wheels which have eccentric cranks. A pair of wheels, once came to the writer's notice of which one side was properly balanced, but which had no lead at all in the other side. These were the main wheels of a Prairie 2-6-2 locomotive type. The locomotive ran satisfactorily up to about 40 m.p.h. when the wheels started pounding and jumping.

Reversible clamp for air brake cylinders

By W. H. Durant

THE horseshoe clamp shown in the drawing is designed for holding the piston rod of air brake cylinders for locomotive tenders and freight cars when removing the piston heads and release spring assemblies.



Clamp designed to hold together the brake cylinder piston and non-pressure head against release spring pressure

The device has been used successfully on this road for a number of months. It is intended to replace the cast iron hinged clamp which was found to be an unsafe device for holding the piston against the tension of the release spring when removing the nuts from the bolts which hold the non-pressure head of the brake cylinder.

A 5/16-in. pin-hole should be drilled approximately ½ in. from the end of a new hollow piston rod before it is riveted to the piston head. Referring to the drawing: A ¼-in. pin is secured to the clamp by a standard bell or whistle chain, 9 in. long. Three 9/32-in. holes are drilled in echelon position in each end of the clamp for the purpose of providing a means of adjustment between the hole in the hollow piston rod and the end of the non-pressure head.

Picked up at Hillyard machine shop

EXCEPT for the heavy machine equipment at the Hillyard, Wash., locomotive shops of the Great Northern, one of the first features to attract attention in the main shop is the general foreman's office shown in

General foreman's office at the Hillyard shops of the Great Northern

one of the illustrations. This office is a neatly painted wooden structure, located approximately in the center of the shop between the erecting and heavy machine bays,

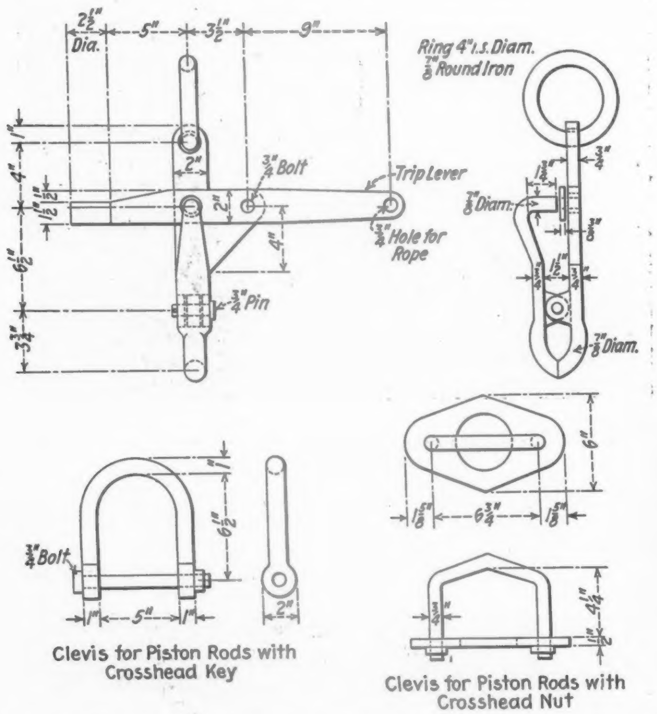
Piston and piston rod supported by the trip tongs and ready for the drop

in accordance with customary Great Northern practice. Numerous large windows give a clear vision about the shop in all directions and, with the door and windows closed, the general foreman has an office largely insulated from ordinary shop noises. Diagramatic drawings are

posted on the outer walls of the office for the information of general shop men and the glass topped writing table and drawer afford a convenient place for department foremen to fill out orders and do other miscellaneous paper work.

An effective method of removing piston rods at the Hillyard shops is also shown in one of the illustrations; the details of the device used are given in the drawing. By this method the piston rod nut is removed in accordance with the usual practice, the piston and piston rod being lifted about 10 ft. by means of a special device supported from the shop crane. The lifting device is tripped, allowing the piston and rod to fall on a specially prepared foundation which forces the piston rod out of the piston at the first blow. It is said that this method never fails at the first attempt, and not only are time and labor saved, but damage to piston rod ends is prevented.

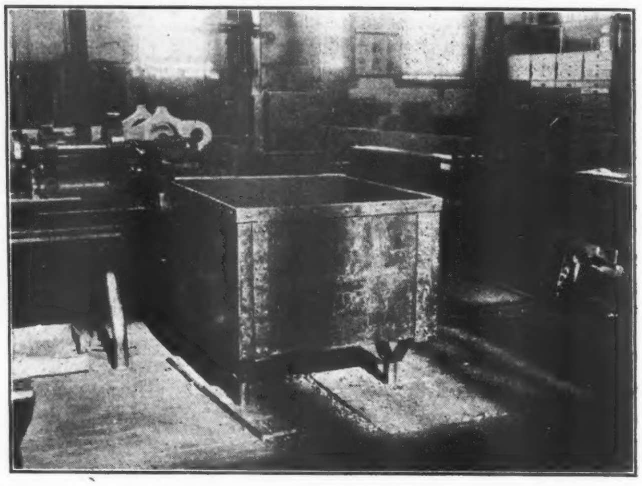
The construction of the trip tongs is clearly shown in the drawings. Two hinged jaws are held together by an ingenious arrangement such that operation of a trip lever by a quick pull on a rope, extending to the shop floor



Details of the trip tongs and the two types of clevises used for coupling to piston rod ends

and well out of range of the falling piston, permits the jaws to separate. A special clevis serves to connect the trip tongs to the piston rod, in one case being made of 1-in. round stock bent to U-shape and having a cross ¾-in. bolt for insertion in the piston rod keyway. For the smaller nut-type piston rods another clevis, also illustrated, is used, consisting of a ¾-in. U-bolt extending through a plate with a 3½-in. hole designed to slip over the crosshead end of the piston rod and to be held by the regular crosshead nut.

Another point of interest at the Hillyard machine shop is the unusually neat type of chip box. These boxes are located at strategic points about the shop, where chips from various machines can be readily dumped into them with a minimum of steps and hand labor. This box is made of riveted sheet metal with four substantial fabricated steel legs supporting it at such a height that an electric truck can be backed under the box. By means of an elevating feature the truck raises the legs clear of the floor, and takes the box to the scrap platform or scrap car. The fact that the chip box does not rest on the



An unusually substantial and neat form of chip box

floor permits the floor to be kept clean under the box, thus adding to the clean appearance of the shop.

Clever container for lampblack

By Frank Bentley

A PRACTICAL container for lampblack grease used for spotting faceplates or other work is shown in the illustration. A discarded grease cup was thoroughly cleaned out and filled with a batch of the grease black-

Lampblack container made from a discarded grease cup

ing. The hex of an old ¼-in. by ⅜-in. reducing bushing was run down on the thread to lock the ¼-in. pipe cap which serves as a cover. Feeding the lampblack for use is a matter of turning the cover. Cup covers which because of worn threads permit the lighter bearing grease to leak out, hold the thicker blacking nicely. This simple device keeps the lampblack clean and prevents it from drying out.

The Reader's Page

Have You a Question? Ask it
Have You an Opinion? Express it

"Jack" started a riot!

When "Jack" refused that five-cent raise under the cirmustances set forth in a letter on the Reader's Page of the August issue, he started something. In response to the question of the writer of that letter, "Is Jack poor foreman material and should he have accepted the increase offered him?" ten letters have already been received—from ten men, no two of whom are in complete agreement as to "Jack's" qualities as foreman material or as to his judgment in refusing the raise. Here are as many of them as space will permit us to publish this month. Others will appear later.—Editor.

How about it, "Bill"?

To the editor:

In an editorial in the August issue of the *Railway Mechanical Engineer,* you say the question of Jack's foremanship material is squarely up to your readers.

Well, in my observations I shall pass by "Jack's qualifications" by merely stating that I think he is a "Poor Nut" and Corporal Smith would be better off without his services.

I would like to express myself rather freely, however, as to Corporal Smith's own foremanship material.

In the first place he should have been intimate enough with Jack's state of mind and his altruistic ideas to know whether he would have appreciated an increase before troubling his master mechanic, or other busy officers, with his very fine tale of Jack's worthiness. I can very easily picture his impassioned address, offering so many reasons why this increase should be granted, instead of busying himself making the rest of the gang do as well. Then, figuratively, patting himself on the back for his shrewdness when he succeeded in getting the raise O. K'd. I imagine he will have a very interesting interview with his master mechanic when attempting to explain why he was unable to spend the money he made such a plea for.

He certainly presents rather a pitiable figure to your advanced readers in asking if Jack is good foreman material. I would suggest that Jack is much better material than he is himself and that if he could not succeed in making Jack accept the raise and gratefully too, he should hunt up "Bill Brown" who it was suggested would be selling hymn books by now, and be given an opportunity to join forces with him, as he appears to be in the same class as that "comic" who made his appearance in your columns in 1925 and who was promptly told just where he was headed to by "Top Sergeant." Admirer of "Top Sergeant"

A qualified approval of "Jack"

Auburn, N. Y.

To the editor:

Whether Jack is good or poor foreman material depends on his temperament, or the much abused term "personality."

The fact that Jack is alive to the other fellows' thoughts should not mitigate against him, for it is seldom that the foreman who has the mental trend of the military officer gets the best out of his men. On the other hand, the foreman who is sympathetic, is a good mechanic, possesses firmness of purpose and has his employer's interests at heart will enjoy the friendship of the majority under him and get production, where Mr. Smith would fail. It is my opinion that Jack would work for his employer and with his subordinates, provided he is a man of character and, if such is the case, the raw material is of better quality than that possessed by Mr. Smith, whose remark is reminiscent of times gone by.

As a general proposition, the employer is best served by the foreman who is loyal, and who accomplishes his ends without friction. "King Charles"

"Private Jones" did not refuse his "raise"

Michigan.

To the editor:

No matter whether you agree with Jack's ideas in not accepting the increase in pay, you will all admire his stand for loyalty to his fellows and his devotion to the cause of better working conditions for his fellow workmen.

Personally, I was called upon to decide for myself the self-same question that Jack was some few weeks ago. My decision? I accepted the raise.

Why did I do so? In the first place I am a firm believer in a sliding scale of wages according to a man's ability, class and quality of work performed. In the second place, if my superior officers consider me entitled to a higher rate than the average, I must be above the average and by study and application to work continue to keep myself above the average so that when a foreman is needed I will stand out head and shoulders above the group when they are being looked over to choose the foreman. If someone else can top me after I've done my best, I'll wish him good luck.

Again, by having a sliding scale of wages there is some incentive for the young fellow just out of his time to pitch in and try for a little more money, whereas if all are paid alike he gets just as much money whether he is just "getting by" or doing exceptionally good work.

Jack might make a good foreman, but no superior officer would dare to take a chance on him after he had expressed his views as he did, refusing the raise for the reasons he gave. If Jack ever made a good foreman it would be only after he had changed his mind in regard to all men being equal. All men may be created equal, but they do not long remain so.

I was in the shopmen's strike in 1922 and remained out until the strike was called off on our road, so I can hardly be classed as one who has no regard for his fellows. Since I've been getting the higher rate I can see no change in their attitude towards me. In fact,

a majority of them look upon my raise as a good argument for more money for them, and so it is.

"Private Jones."

Quotes an authority on management

Marshall, Tex.

To the editor:

In my opinion the question should be stated in two parts. (1) Is Jack poor foreman material? (2) Should he have accepted the increase offered him?

Granting that Jack had no ulterior motive, I would say to (1) that Jack is good foreman material, first, because of his recognition of the importance of harmony; second, because of his ability as a workman, and, third, because of his willingness to accept responsibility.

Answering question (2), Jack should have accepted the increase offered him. To the degree he had shown individual ability as a workman the company was willing to compensate him.

Jack's mistake in refusing the increase and thinking his fellow workmen would be offended on account of the varying rates of pay probably would not have been made if he had been familiar with the principle of management. Quoting from Vol. 48 of the American Society of Mechanical Engineers,* paragraph 17, page 397, "Leadership in work, as in all other human activities, has always been exercised and followed." Paragraph 18, "Incentive reward: Promise of reward for achievement for getting something done."

Paragraph 49, page 49, "Law of Leadership: Wise leadership is more essential to successful operation than extensive organization or perfect equipment."

A Reader.

* The references are to a paper by L. P. Alford presented at the 1926 annual meeting of the society.

"Jack" better for apprentice instructor than foreman

Minden, La.

To the editor:

I have been supervising railroad mechanical forces for a good many years and will say, frankly, I have never come in contact with a man who would refuse an increase in pay under any circumstances; that is, in the line of work in which he was engaged. My opinion is that Jack was wrong in not accepting the increase. I think "Corporal Smith" also was wrong in offering it under the circumstances.

First, Jack having the interest of his fellow workers at heart, could hardly hope, by his superior ability, to get a raise in pay for the entire shop. To my mind his acceptance would have been the better way as it would have been an incentive to his associates to do more and better work and put themselves in line for the same recognition. I believe a man who can, and does, more work at the same rate of pay will be less popular with his craft than if he accepted a higher rate for his work.

Second, I believe Corporal Smith was wrong, because in this instance the men, working under an agreement having rates fixed to cover the class and not the amount of work performed, would have felt harder toward "Smith" than toward "Jack."

I do not think Jack should be eliminated as a prospective foreman. Certainly his concern as to what his fellow workers might think about him would not disqualify him. Yet, his ability to get more and better work from a machine would scarcely prove that he would be able to get the same results with a force of men. I would say that Jack would be a much better prospect for an instructor of apprentices on machines than for a foreman. Possibly he may be nothing more than an excellent boring mill operator.

J. B. Searles.

"Jack" too good for a railroad shop

Flint, Mich.

To the editor:

The Jack referred to is evidently a victim of circumstances. By working in a railroad shop, he has become a part of that notoriously unfair practice of the flat rate system of pay. I fail to see that he is even open to criticism for refusing a higher rate than the recognized standard that is being paid to his side pal. He has probably seen the boss's pet reimbursed in some other shop and the few cents offered him would not offset the discordant note that would creep between him and his fellow workmen.

The trouble with Jack is that he is a misfit in a railroad shop. The special gifts with which he is endowed were given him to make use of. Let him go to some modern shop where a man is paid according to his ability and the quantity and quality of work he produces. It is only the railroad shops and moss covered soldiers' homes where the antediluvian flat rates of pay still exist and where a man is forced to make excuses to his fellow workmen for accepting an increase in pay.

I agree that there must be an incentive to get the best out of any man, but it cannot be created by a raise in pay for a dozen men out of three or four hundred. Jack would not be riding to work in his "Tin Lizzie" if Henry Ford had been satisfied to pay his men for punching the time clock instead of by the number of pieces produced. Therefore, do not condemn Jack for refusing the raise, but condemn the system that does not honestly pay him his full value.

Jack Jones.

Was "Jack" married or single?

To the editor:

The letter to the editor in the August *Railway Mechanical Engineer* entitled "Was Jack Right?" is the story of a very unusual occurrence: a workman refusing an increase in wages.

In order to form an opinion as to whether Jack was wise or unwise, let's get "behind the scenes" in that foreman's office and see what qualities in Jack's make-up impelled him to refuse that differential, and then see if these qualities tend to prove good, mediocre or poor foremanship material.

Let's quote Jack—"I am doing the best I can—I know the rest of the gang are doing the same." Perhaps true to the extent that it is possible to have all the men in any shop, "doing their best"; but Jack is telling his foreman in so many words that he is really not working any harder than the rest of the gang. Possessing the natural ability to excel on that particular machine or perhaps even in most branches of his trade, he is perhaps not working as hard as some of the mediocre mechanics producing only an average in both quality and quantity. This characteristic is truthfulness.

Then he says, "If I accepted the raise some would be sure to get sore—and the result would be a certain amount of dissatisfaction." Where is the foreman who does not know this to be true?

If Jack had been placed in a sort of a semi-supervising capacity with some authority and consequently some responsibility to offset the increase in his rate, the "gang" would in all probability have welcomed the news, knowing that Jack's ability and experience would tend to make better mechanics of them all, but to grant an increase to one man over all other mechanics in the service (even though no doubt some of them had been in the service longer than he) with no change in his duties, would surely result in a great deal of animosity which

would without doubt be reflected in the attitude of the rest of the workmen towards the recipient of the increase and very possibly result in Jack resigning, in which event both Jack and the company would be the losers. Does not this decision show quick-thinking and far-sightedness?

Next, Jack says, "Do your best to get us all a little more and let what little extra you may get out of me help out the guy who can hardly make the grade."

This is a quality seldom found in the rush and bustle of business today about which alone chapters could be written: tolerance and broadmindedness, that great asset of a foreman who hopes to build up an efficient co-operating working force, and who realizes that all men, at least all mechanics are not equal, even though their rates of pay are the same. Next, this man shows by his request for a promotion that he had ambition and by his reminder to his foreman that methods of handling men have changed greatly during the last few years he shows that he is observant.

Right here I'd like to digress long enough to say that if the railroad managements had given as much thought, time and money to the idea of co-operation with their employees previous of 1922 as they have been giving since then, there would have been no strike of that year.

The last sentence of Jack's talk shows he is in full sympathy with the idea of co-operation between management and employees, and it is safe to assume that as a foreman he would be animated by that same spirit, a most valuable characteristic.

On the whole Jack shows himself able to think quickly, express views clearly, talk courageously, and last but by no means least, he shows himself able to stand on his own two feet. What more do you want for foremanship material?

Would he succeed? Ah, that's quite another question. *There's a vast difference between possessing foremanship material and making good as a foreman.* Many a light is hidden under the bushel of suppression. So my answer to the first part of your question is "no."

To the second half, there is a lot of unknown circumstances that must be considered. If Jack is an unmarried man and probably spending a large part of his earnings or most of it on himself, which is the case in a few instances of like nature of which I have personal knowledge, he probably was wise in valuing the friendship and comradeship of his fellow-workers, with whom he would probably be working for a long time, above the five-cent increase. If, on the other hand, he was married and possibly had a family, he would undoubtedly owe more consideration to them than to what the gang at the shop would think of him for accepting a raise in wages voluntarily offered by the management and fully deserved by him. These circumstances would decide my answer.

"COLONEL AL."

Substituting cast steel for wrought iron yokes

DETROIT, Mich.

TO THE EDITOR:

On the Reader's Page of the July issue of the *Railway Mechanical Engineer* relative to the question that was asked in May as to whether the substitution of a cast steel coupler yoke for an A.R.A. standard wrought iron coupler yoke constituted wrong repairs, I note it is stated "No standard cast steel yoke has been adopted by the American Railway Association."

Upon referring to the Supplement to the A.R.A. Manual of Standards, I find on page 123 plate No. 231 showing a cast steel coupler yoke. Is not this an A.R.A. standard yoke, and must not a yoke of this type be maintained in making repairs to foreign cars?

W. F. CROWDER.
General Car Inspector, Pere Marquette.

(The cast steel coupler yoke shown on page 123 of the Supplement to the A. R. A. Manual of Standards is recommended practice and has not been adopted as standard. Parts standard to the car must be maintained.—*Editor.*)

Wanted—Copy of 1896 M.C.B. Proceedings

SYDNEY, Australia.

TO THE EDITOR:

I should like to obtain a copy of the 1896 M. C. B. proceedings, especially the report which is published therein on the methods for calculating stresses in axles. I should appreciate it very much if you would make inquiry on the Reader's Page of the *Railway Mechanical Engineer* in the hope that perhaps some reader has a copy he would be willing to let me have.

LAWRENCE H. HART.

Stripping locomotives—An opinion

PARAGOULD, Ark.

TO THE EDITOR:

Some years ago one of the transcontinental railroads employed an industrial engineer who adopted practically the same method of dismantling locomotives when receiving general repairs as outlined by "Observer" in the August issue of the *Railway Mechanical Engineer*.

Right or wrong, this method has long since been abolished by the railroad referred to and the former method of stripping locomotives re-employed. Unless a locomotive receives a thorough overhauling at the time it goes into the shop for general repairs and is made practically as good as new, it is usually the case that it arrives back in the shop again for the same kind of repairs before it has made its mileage. When general repairs are not properly made, an extra burden is placed on the enginehouse, the repair facilities of which are usually not planned to handle heavy repair work, and there is invariably an increase in maintenance expense and loss of locomotive time on the road.

Relative to the subject of renewing rod and crown brasses at the time a locomotive receives general repairs, the practice of only renewing brasses that are worn below certain prescribed limits instead of renewing all of the brasses, in my opinion, is not a good one. A few worn brasses throw added stress and corresponding wear on the new brasses, thus necessitating earlier renewal in the enginehouse where the expense of doing this kind of work is usually in excess of what it costs to do the work in the backshop.

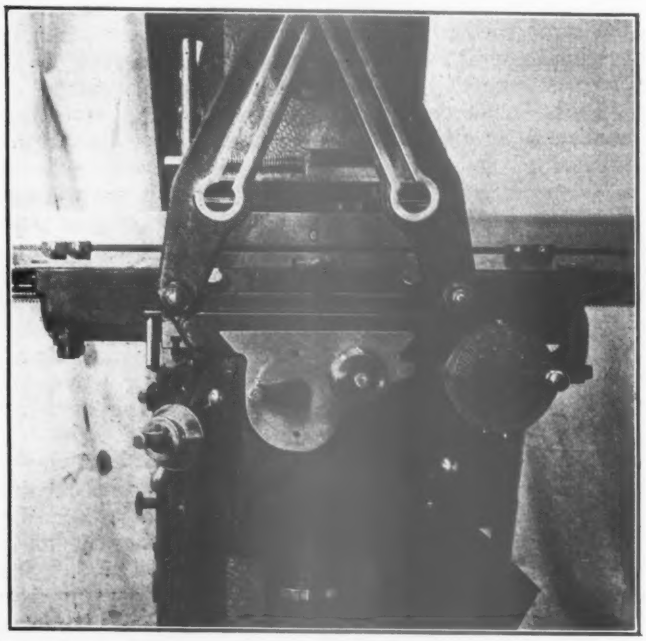
"Observer's" plan will undoubtedly materially increase backshop production, but quite often the economy resulting from such methods of stripping locomotives as he suggests places an increased burden on the enginehouse. Too often departments overlook the fact that there are other departments to be considered in working out economy programs.

L. SHOWELL.

Two Kearney & Trecker milling machines

NUMBERS 2 and 3 standard milling machines built in the plain, universal and vertical types have recently been placed on the market by the Kearney & Trecker Corporation, Milwaukee, Wis. Such features as power rapid traverse, Timken roller bearings, and the low pressure coolant system common to all the milling machines built by this company, have previously been described. However, the front dial feed control is a feature new to these two models of milling machines.

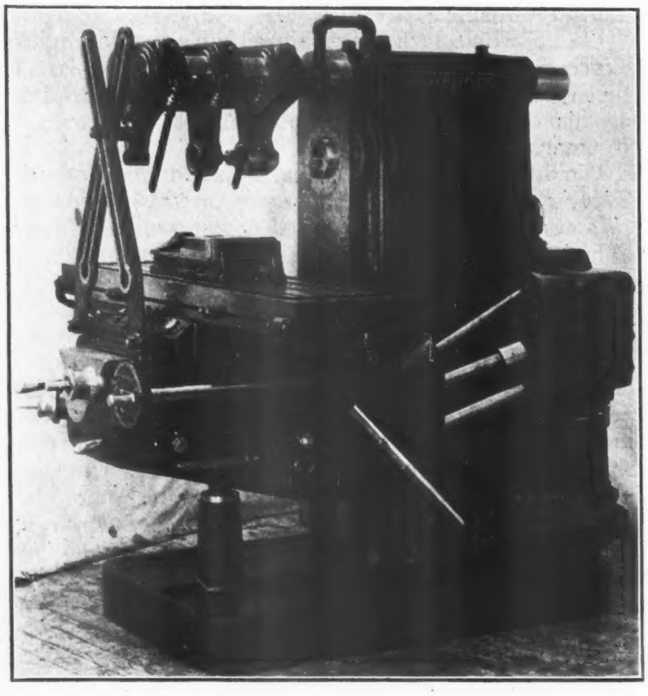
A single crank lever and direct reading dial, located at the right front of the knee, makes it possible to secure 18 changes of feed, either when the machine is running or idle.



Front view showing the location of the front dial feed control

The feed box is located at the rear of the column. It is of the sliding gear, selective type. All the gears are of alloy steel, heat treated and hardened. The entire box is automatically lubricated by the same pump that lubricates the inside of the column.

Passing along the right side of the column at the front of the knee, is a universal joint shaft on the front end of which is mounted a single crank lever for changing all feeds. The dial, with the numerals on it, revolves with the crank handle. The outer rim, and the inner portion on which the arrow is mounted, remain stationary. There are two holes 180 deg. apart, in which the plunger engages. One-half a revolution of the crank is all that is necessary to change to the next highest or lowest feed.



One of the new model Kearney & Trecker milling machines

The crank is turned with one hand in either direction until the feed desired is opposite the arrow. There are but two positions in which to engage the plunger, but it is not necessary for the operator to pay any attention to them. When any desired feed number on the dial is brought into position above the arrow, the plunger will always be directly opposite one of the two holes. All the operator has to do is let go of the spring plunger handle.

There are several advantages obtainable with this construction. Both the number of feeds and range of feeds

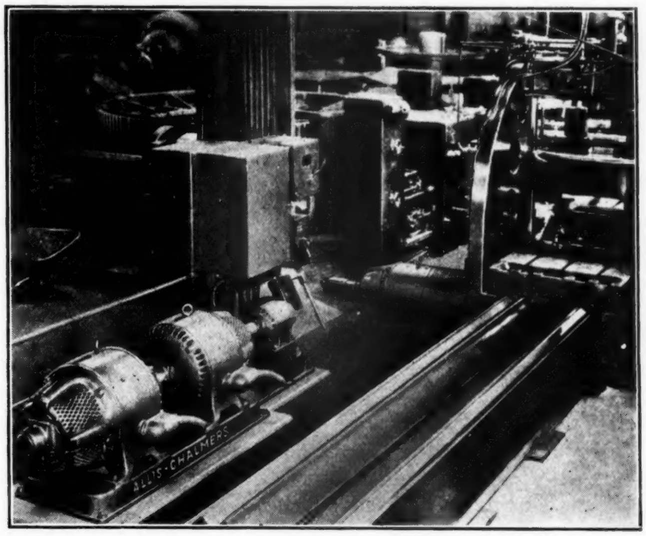
has been increased. There are now 18 changes available. varying from 5/16 in. to 25 in. per minute. The rotary dial is direct reading. There is no chart or table to study out, and if the foreman in charge walks past and wants to know what feed the operator is using, he can tell at a glance by merely reading the number at the top of the arrow.

The feed control is at the front of the machine. The feed box is at the rear. This enables the feed box to be made large and does not confine the design to small gears. The feed box can be automatically lubricated the same as all other gears and bearings inside the column. The necessity of raising and lowering excessive weight, were the feed mechanism built into the knee or attached to any front part of the machine, has been eliminated. By placing the feed box at the rear of the column, it may be quickly assembled or removed as a unit when desired. All of the principal shafts in the new feed box are mounted on New Departure ball bearings, giving a free running mechanism.

A high-speed planer drive

THE Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has recently developed a planer drive which has a number of unusual features to facilitate greater production. With this drive a much greater range of speeds are available than heretofore attained—10 to 85 ft. per min. cutting speed with full torque available, 180 ft. per min. return speed, and 50 or more different cutting speeds, completely automatic with a new type pendent control. It has large overload capacity and can be furnished to operate on any direct current or alternating current circuit.

The range of speeds is accomplished with increased smoothness in acceleration and reversal and with less wear and tear on the equipment. The control is all automatic and care has been taken to provide every means of safety to the operator, the equipment and the work. An important safety feature protects any part of the equipment or the planer from injury should the power supply be cut off. The planer motor is of special de sign to withstand the severe strains of reversing planer service. The rotating parts have a large factor of safety, dynamically balanced and low inertia.



The Allis-Chalmers high speed planer drive

Redesigned cotter and keyseat miller

DESIGNED primarily for milling cotter ways and keyseats in locomotive crossheads, piston rods, axles, etc., the redesign cotter and keyseat miller built by the Niles Tool Works division of the Niles-Bement-Pond Company, Hamilton, Ohio, can be adapted to many similar operations in railroad shops. The attainment of higher spindle speeds and improved collet construction have made the machine suitable also for milling keyseats in many smaller jobs found in locomotive shops, such as lift shafts, brake fulcrum shafts, valve stems, wrist pins, brake rigging pins, etc. The machine has a capacity to mill splines up to 36 in. long by 2½ in. wide by 16 in. deep, and the chuck jaws will grasp work up to 12 in. in diameter.


Bement No. 3 cotter and keyseat miller equipped with a variable speed motor drive

The bed is provided with a trough and pan for collecting the cutting fluid which drains to a receptacle, from which it is delivered by a pump to the cutting tools. The carriage has a reversible longitudinal traverse on the bed, four different rates of feed being available, ranging approximately from .8 in. to 26 in. per min. The carriage longitudinal feed is obtained by a screw placed centrally with the bed and is automatically reversed by trips at each end of the stroke which can be set to any desired length. Ball bearings are provided at each end of the screw to take the thrust incidental to the carriage and cutters.

The two spindle heads mounted on the carriage have an adjustment transversely with the automatic feed in an inward direction towards the axis of the work. The spindle heads may be used independently or in unison, depending on whether single or opposite keyways are to be cut or whether through slots are to be milled. Spindles are 4 in. in diameter and are arranged to receive No. 5 Morse taper sockets which are bored out for No. 4 Morse or No. 9 Brown & Sharpe split taper collets hav-

ing a 7/16-in. hole for holding cotter drills as listed by Pratt & Whitney, a division of Niles-Bement-Pond, and Brown & Sharpe.

The cross feeds to the cutter spindles range from approximately .004 in to .030 in., feeding at each end of the carriage stroke. An automatic stop is provided which is employed at such times as two opposite drills are cutting through a slot, throwing out one of the drills when the two are closely approaching each other at the center of the work.

The machine is regularly furnished with a pair of self-centering chuck jaws fixed for height and adjustable longitudinally on the bed. The jaws are lined with hardened and ground steel plates, and the chuck bodies are gibbed to their bases, provision being made for fine adjustment in all directions. Additional equipment, which can be furnished for special work, includes a pair of centers, elevating chuck jaws and a flat table.

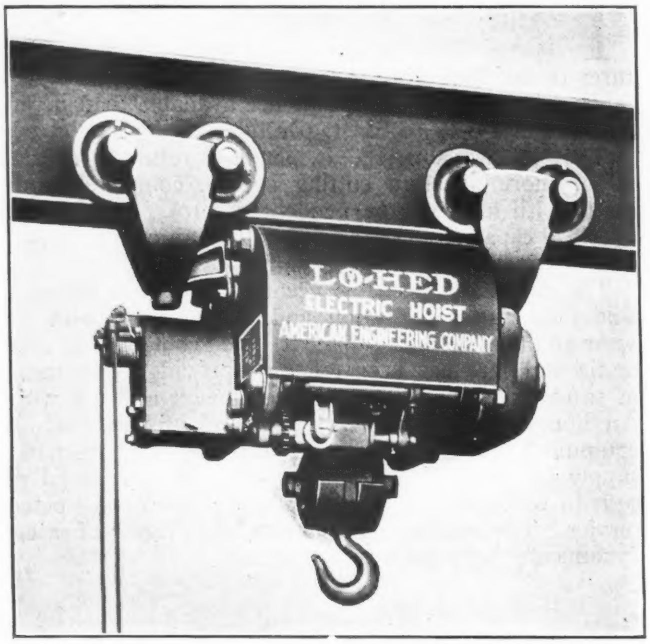
The machine may be driven by a belt, a direct-current, variable-speed motor or an alternating current constant speed motor through a four-speed gear box. A 5-hp. motor is required.

An electric monorail with an eight-wheel trolley

An electric monorail hoist that operates in 15½ in. headroom has been developed by the American Engineering Company, Philadelphia, Pa. This hoist is built in half ton and ton sizes and is similar in construction to the standard Class A Lo-hed hoist, except that it is mounted on an eight-wheel trolley that reduces the headroom requirement by more than 5 in.

It is made for operation with alternating current at 20 ft. per min. or direct current at 20 to 40 ft. per min. and a special high-speed hoist provides for operation at 40 ft. per min. with alternating current and 40 to 80 ft. per min. with direct current. The standard height of the lift is 20 ft. But when required, a lift of 25 ft. can be provided. Four ropes are used.

The hoist travels around curves of short radius; shifts easily over switches and is protected from dust and moisture by metal covers. The motors are fully enclosed. The mechanical efficiency is over 80 per cent. Hyatt bearings are used on the gear shafts and in the trolley wheels. A ball bearing motor designed especially for hoist service is used. The drive between the motor and drum is of the spur gear type and runs in oil. Alemite lubrication is provided on all bearings not automatically lubricated by the oil bath. The holding and lowering brakes give full control of the hoist at all times and combined with a positive acting upper limit device, insure safety in operation.

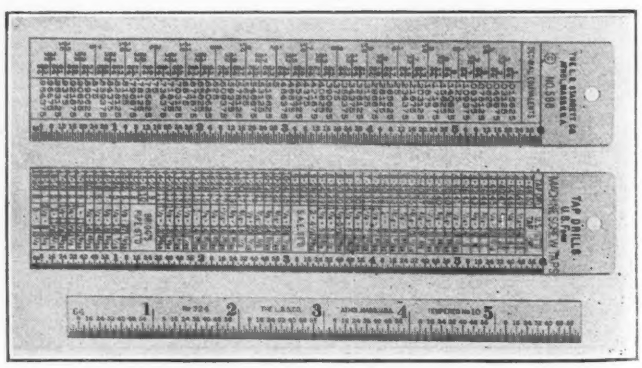


An electric monorail with an 8-wheel trolley that reduces the headroom requirement to 15½ in.

Steel rules for machinists and toolmakers

Two flexible 6-in. steel rules that provide greater convenience of use for toolmakers and machinists have been placed on the market by the L. S. Starret Company, Athol, Mass. The flexible 6-in. steel rule, No. 324 is graduated for greater convenience of use for toolmakers and machinists. The rule is designed especially for close work as it is graduated in 1/64 in. on one side and 1/32 in. on the other, both in quick reading figures. The graduations are on opposite sides and opposite edges and from one end. This feature permits quicker measurements as the rule is always in a natural measuring position. There is no need to turn the rule end for end.

The Starrett ready reference table rule No. 588 is handy for toolmakers and machinists. One side has decimal equivalents, fractions and a 6-in. rule with 1/32 in. divisions, the other side has tap and drill data and a 6-in. rule with 1/64 in. divisions. Two advantages of this table and rule are the quick-reading features of both the 1/32 in. and 1/64 in. divisions and the natural reading position of the graduations on both sides. It is not necessary to turn the rule end for end or to measure with figures upside down, as the graduations are on opposite edges and from the same end of the rule.



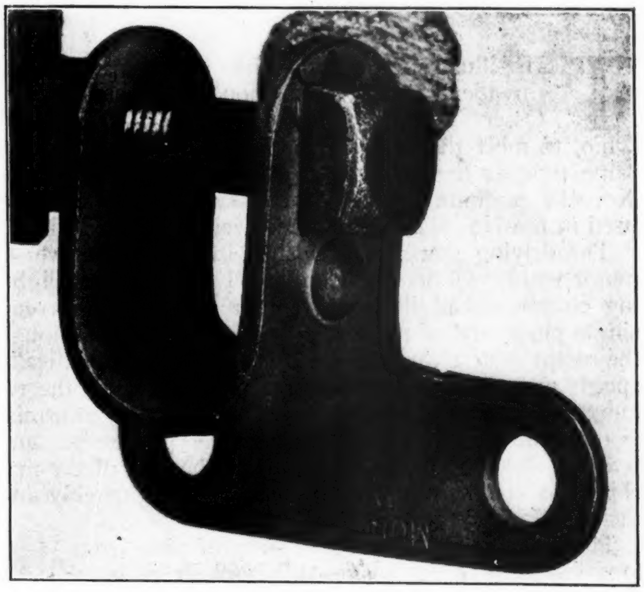
The top view shows the fractions and decimal equivalents on one side of Rule No. 588 and the middle view shows the tap and drill data on the opposite side—The bottom view shows the Starrett No. 324, 6 in. flexible steel rule

Brake pipe clamp and angle cock holder

MUDGE & COMPANY, Railway Exchange Building, Chicago, has redesigned and placed on the market a brake pipe support and clamp and a combination brake pipe clamp and angle cock holder. Both devices are one piece and made of pressed steel, utilizing an ordinary ¾-in. bolt to effect the clamping of the pipe. The clamping principle of these devices is simple. When the brake pipe or angle cock is in place, the ¾-in. bolt is applied and drawn up tight. This action draws the legs of the clamp inward and they in turn bear on the bolt and force it hard against the pipe. The pressure of the bolt and large bearing surface of the clamp against the brake pipe resists vibration or movement of the pipe. The nut is automatically locked in place by the angularity of the clamp legs.

A combination brake pipe clamp and angle cock holder

The angle cock holder is provided with a lip which projects over the hex of the angle cock, preventing the latter from turning. The combination of this lip and clamping of the pipe back of the angle cock prevents distortion or loosening. Variation of as much as ½ in. in length of the brake pipe nipples applied in renewals do not affect the efficiency of the angle cock holder. It will still serve its purpose without having to be relocated.



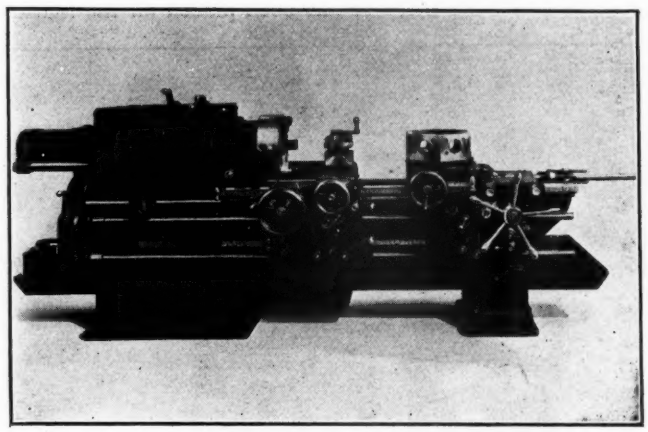
The Mudge brake pipe support and clamp

Gisholt universal type turret lathe

THE Gisholt 2L turrent lathe manufactured by the Gisholt Machine Company, Madison, Wis., is designed to accommodate a great variety of medium sized work such as bar work up to 3½ in., or chucking work up to 16 in. in diameter. It is provided with a massive bed, and the headstock walls are carried well up above the spindle and back shaft bearings so that no gearing is carried in the covers. All shafts are held in permanent alinement. The power is transmitted from the single pulley drive through a multiple disc friction clutch of bronze and saw steel plates running in oil, through a train of hardened alloy steel gears, giving 12 speeds and reverse. The speed changes are accomplished by sliding gears on splined shafts. The spindle is mounted in cylindrical babbitt bearings carried in tapered cast iron shells for adjustment. The spindle thrust is taken on a large ball bearing against the housing. All other shafts transmitting power, including those in the apron, are mounted on large ball bearings.

The machine is of the universal type, having a square turret on the side carriage, and a cross feeding hexagon turret on the rear carriage. A fixed center turret is furnished as optional equipment.

A total of 16 feeds are provided, eight independent feed changes being located in each apron with another feed change at the end of the machine. A lead screw thread-cutting device is furnished whenever the work requires thread chasing. A taper attachment is located in the side carriage or may be attached to the cross feeding turret carriage.



The Gisholt 2L Universal type turret lathe for bar and chuck work

A rapid traverse is provided for the longitudinal movement of the side carriage and of the turret car-

riage, and there is also a rapid traverse for the in-and-out movement of the square turret on the side carriage cross slide.

The flat ways of the machine are covered with hardened steel plates and lubrication is by a force feed through the bottom of the two slides. The headstock and spindle bearings are lubricated by splash and the transverse and feed works are lubricated by fresh oil under pressure.

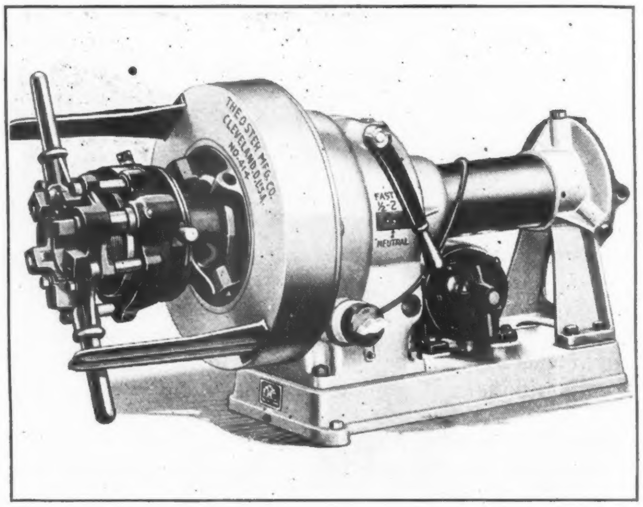
The machine is driven by a 10-hp., 1,200 r.p.m. motor, connected by a vee belt, flat leather belt or silent chain. The weight of the bare machine is 7,200 lb.

A 4-in. portable pipe threader

THE illustration shows the 4-in. portable pipe threader recently placed on the market by the Oster Manufacturing Company, Cleveland, Ohio, to meet the demand for a larger machine of the same type as the Oster No. 412, 2-in. machine. The No. 414 machine is built of the same aluminum alloy used in the No. 412 machine and weighs only 380 lb.

The driving power is furnished by a ½-hp universal motor which will operate from any 110 or 115 volt lighting circuit, either direct current or alternating current, single phase and of any cycle from 25 to 60. Although the motor is of a variable speed type which automatically speeds up on the smaller sizes of pipe and holds the required speed on the larger sizes, a two-speed transmission is also used to further increase production and power. A handy gear shift lever on the side of the machine enables the operator to change speeds quickly and easily.

The machine will handle all sizes of pipe from ½-in. to 4-in. through its barrel and will drive geared die stocks from 4½-in. to 12-in. by an auxiliary drive shaft. Any square end or roller type pipe cutter of 2-in. capacity can also be driven. The pipe is held stationary in a three-jaw self-centering chuck and the pipe tools are turned by the driving arms. Self-centering universal guides in the rear of the machine assist the front chuck in centering long pieces of pipe. The machine is 24¾ in. high, 47 in. long and 20 in. wide.

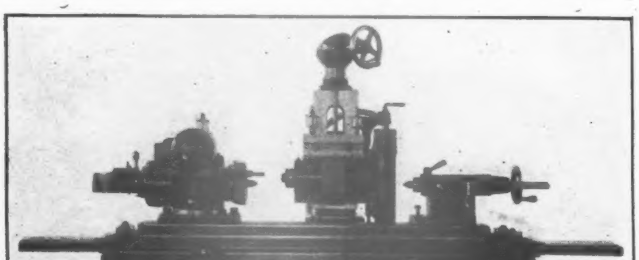


The Oster No. 414, 4-in. portable pipe threader

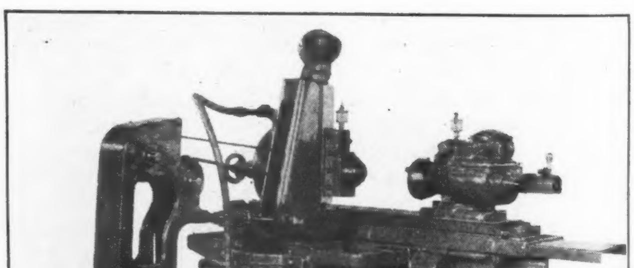
The Bath motor-driven universal grinder

A SELF-CONTAINED, full universal grinding machine equipped with Timken bearings and with a five speed individual motor-driven head stock, with one main drive motor for the full wheel spindle and table traverse has been placed on the market by the Fitchburg Grinding Machine Corporation, Fitchburg, Mass.

The 1⅝ in. diameter spindle runs in self-alining 4½ in. bronze bearings 4 in. long. The spindle has three



Front view of the Bath No. 2 S. C. grinding machine



The location of the main and headstock motors

speeds: namely, 1,850, 2,300 and 2,800 r.p.m. The vertical movement of the wheel head is 7½ in. The elevating screw is provided with a micrometer reading handwheel graduated to .001 in. The swivel table has four grinding tapers and swings on a central stud. It is provided with a scale graduated in inches per foot up to 2¾ in. per foot each side of the center.

The swivel base of the headstock is graduated to 90 deg. The headstock is provided with a 2-in. spindle which revolves for chuck and face plate work and can be locked for grinding on dead centers. The foot stock spindle of 2-in. diameter has a variable tension spring controlled by a handwheel and may be clamped rigidly for supporting the center.

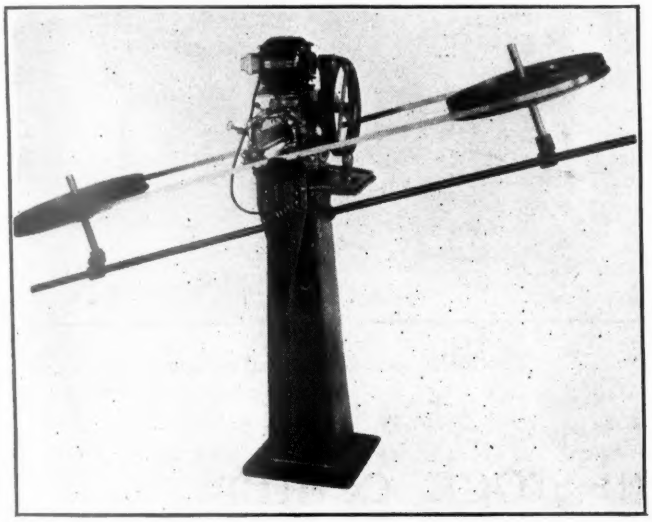
A 3-hp., 725 r.p.m. motor is used for the main drive. A built-in ¼ hp., 1,725 r.p.m. motor is used to drive the headstock. The speeds of the grinding wheel and work and feed of the table are independent of each other. This feature is desirable in toolroom work.

The machine is built in two sizes. The principal dimensions of the two machines are as follows:

	No. 2 S. C.	No. 2½ S. C.
External, cylindrical swing	10 in.	12 in.
External, cylindrical, takes length	25 in.	36 in.
Internal swing	10 in.	12 in.
Internal swing, takes length	8 in.	10 in.
Surface length	20 in.	25 in.
Surface width	9 in.	9 in.
Height under 8-in. dia. wheel	7½ in.	7½ in.
Disc diameter	16 in.	18 in.

Foley automatic saw filer

THE model F-5 combination saw filing and jointing machine manufactured by the Foley Saw Tool Company, Inc., Minneapolis, Minn., is designed to sharpen band, circular, hand, back, mitre, and buck saws. It handles band saws from ⅛ in. to 4½ in. in width, and circular saws from 3 in. to 16 in. in diameter. Large saws up to 24 in. in diameter are handled by a special vise. It files any saw having three points to the inch and up. It has a right and left feed mechanism consisting of feed pawls for all types of saws, and a left rocker arm for filing hand saws and for filing circular saws when feeding on the left side of the machine. Three right rocker arms are furnished, one for retoothing hand saws, one for filing circular saws with teeth that can be filed with a three-cornered file, and one for filing band saws.



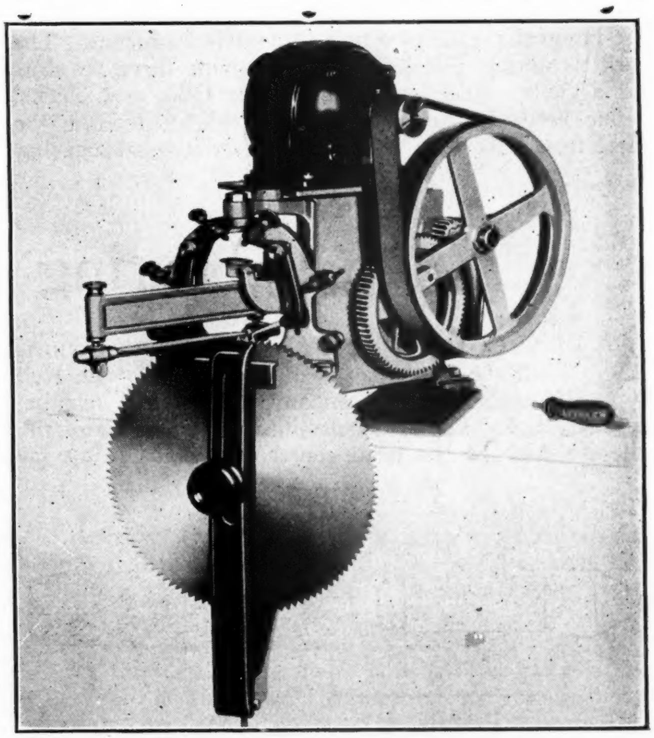
Filing a band saw on the Foley Model F-5 automatic saw sharpener

The machine is made on a cast iron quadrant base which supports both the machine and motor. The main frame, vertical slide frame, horizontal slide, flywheel and vise frame are all of grey cast iron. The wearing parts are of hardened steel and bronze bushings. The filing arm works under an adjustable steel gib. The cam works against a hardened steel plate.

These machines are fully automatic—once started, they need no further attention, except to check adjustments as the filing progresses. The operation is simple. To the drive shaft is connected a hardened steel cam, that raises and lowers the slide frame. The band saw attachment is adjustable to allow the file to clean out the throat of saw teeth and to allow a file to enter and leave any hook of tooth. To insert the band saw in the machine requires only a moment. The band saw attachment is set in place in the slot in front of the machine by tightening with a hand wheel; it also adjusts the up and down movement. The band saw is then placed in the slotted grooves of the attachment and the vise tightened with the double hand wheels.

A cone circle saw arbor for saws with ½-in. to 1⅞-in. holes, is adjustable to take care of saws 3 in. to 16 in. in diameter, inclusive.

The filer is constructed to take hand, back and mitre saws by the use of a pair of plain clamping bars.



Filing circular saws

Graduated bars are furnished when desired for retoothing hand saws. On the arm of the cam is a hardened steel roller which operates the horizontal slide and filing arm. Two adjusting screws cover the movement of the pawl levers which are attached to the rocker arm

and rocked by the file carriage frame as it raises and lowers. There are two cam adjustments controlling the length of the stroke. The amount of cut removed from the face of the tooth is governed by two file holder screws under positive setting.

All saws, including hand, back, band and circular are jointed and filed at the same time, and teeth made of equal size, height and spacing by straight across filing, allowing the feed finger to feed into the tooth.

A direct or alternating current, ¼-hp. motor is required. Single phase alternating current motors of 110 or 220 volts, 60 cycles, are especially built for operating continuously under practically uniform load. The speed at full load is 1,725 r.p.m. The motor is completely equipped with a switch, cord, and socket for attaching to a lamp socket. The motors are self-starting and are placed on top of the filer where they are out of harms way and accessible for repairs.

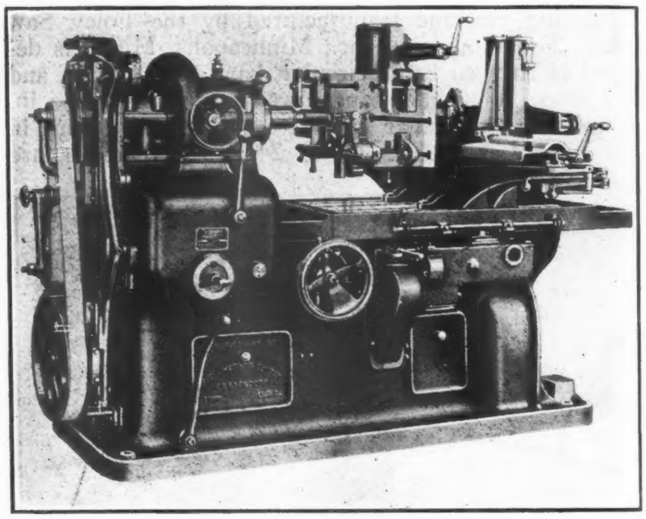
Locomotive valve gear link grinding attachment

THE Micro Machine Company, Bettendorf, Iowa, has placed on the market a new locomotive valve gear link grinding attachment applicable to either of the Micro internal grinders, Models D. G. or F. G. The ½-hp. 1,750 r.p.m. driving motor is an integral part of the fixture, making for a self-contained unit which locates in the center T-slot of the work table.

Walschaert, Stevenson, Young and other types of links with radii within a range of 20 inches to 100 inches can be ground. A scale is provided on the trunnion slide for quickly setting to the desired radius. Quick set up brackets are furnished for holding the link in position for grinding. The diamond for the dressing wheel is conveniently located. The travel of the work platen is governed by adjustable reversing dogs on the slide bar located on the rear of the fixture. The main machine table oscillates slightly to insure uniform wheel wear during the grinding operation.

The horizontal slideways of the fixture are 10 inches wide by 36½ inches long. The table is heavily ribbed, with the trunnion and vertical slide for the work platen cast integral. The total cross travel is 30 inches. The work mounting platen is provided with three tee-slots and a center hole for mounting the links and blocks. A fine vertical adjustment is provided for feeding the wheel to the work. A special heavy duty, ball bearing spindle which holds a wide face wheel is supplied with the fixture, also water facilities to grinding wheel.

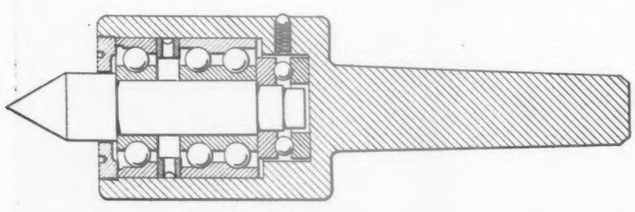
The net weight of fixture, spindle, and accessories is approximately 1,300 lbs.



The Micro link grinding attachment

A ball bearing tail-stock center

A BALL bearing tail-stock center that turns with the work has been developed by the Kell Manufacturing Company, 228 Jelliff avenue, Newark, N. J. The shank fits into the tail-stock of the lathe in place of the dead center, the point being inserted in the center hole of the work in exactly the same manner as with the dead center. Instead of the work revolving upon the point of a dead center, the center itself revolves with the work.



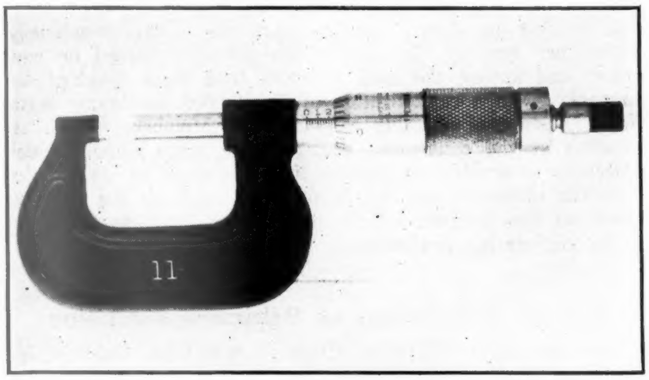
A ball bearing tail-stock center which turns with the work thus reducing friction

Friction between the work and the center point is thus eliminated, and as no heat is generated it is not necessary to lubricate the point. There is no wear upon the point, it cannot be burned and regrinding is not necessary. The center hole in the work is not enlarged. In the case of a soft metal tube, the outside can be turned without affecting the finished interior of the work, as the center-point turns with the work. There is no cutting or ringing of the metal as there would be with a dead center.

The point of the live center revolves on single and double-roll angular contact, radial ball bearings. The thrust load is taken on a ball thrust bearing. All these bearings are standard sizes and of large load carrying capacity with a liberal factor of safety. The center-point is made of tool steel, hardened and ground within close limits which, with the high precision of the bearings upon which it is mounted, insures accuracy and serviceability and as nearly as possible, the elimination of all friction. The bearings are completely protected from dirt and chips; they run in oil, insuring constant lubrication, and when the charge of lubricant is exhausted it is easily renewed through the oil cap located over the rear ball bearing race.

Micrometer caliper with an adjustment for wear

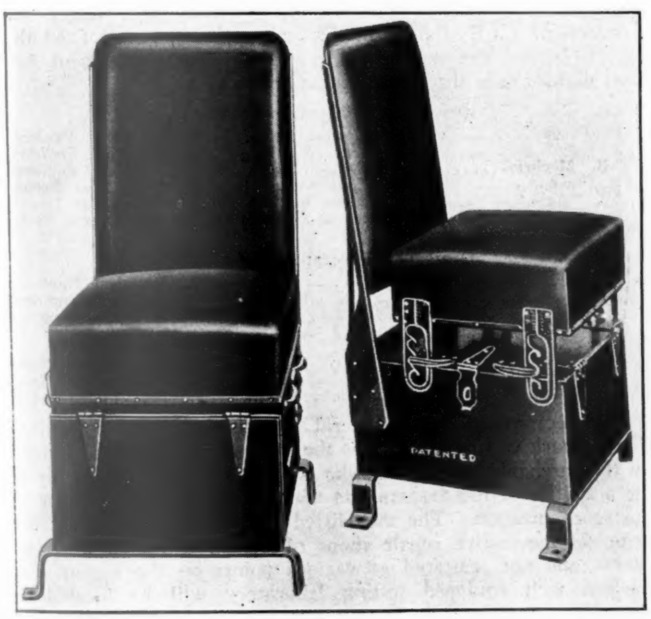
ADJUSTMENT for wear of the measuring surfaces can be quickly effected by means of a patented feature on micrometer caliper No. 11 recently placed on the market by the Brown & Sharpe Manufacturing Company, Providence, R. I. After an adjustment has been made, the parts are positively locked. The shape of the frame makes possible the measurement of many parts that could not otherwise be handled. The small size of the frame at the anvil end adapts the micrometer for taking measurements in narrow slots, while the increased inside width of the frames makes it possible to accommodate odd-shaped pieces having projections and recesses. Measurements from 0 to 1 in. can be made in thousandths of an inch.



The Brown & Sharpe No. 11 micrometer caliper

Adjustable locomotive cab seat development

A COMBINATION adjustable locomotive cab seat and welded steel box for tools, clothes and emergency equipment has been developed by the Gustin-Bacon Manufacturing Company, Kansas City, Mo. The seat may be adjusted for any desired height or tilt. There are four one-inch adjustments for height. The seat swings up on the front hinges to give access to the welded steel box. The seat cushion is built up with a double set of coil springs to give easy riding qualities for either light or heavy men.

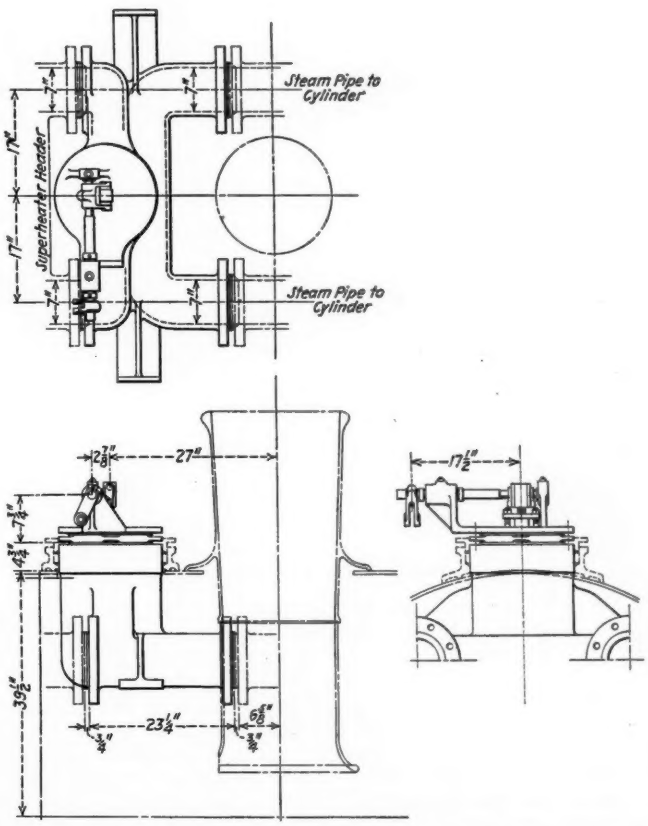


A combination adjustable cab seat and welded steel box for tools, clothes and emergency equipment

Front end throttle valve located to reduce weight

WHEN the Chambers front end throttle valve, manufactured by the Bradford Corporation, 25 West 43rd street, New York, was originally designed, it was placed ahead of the stack for the reason that in many modern locomotives, additional weight is desirable at the front of the boiler in order to keep the proper distribution of the load on the driving wheels and leading and trailing trucks. In some cases, the additional weight is a disadvantage and to meet this situation, the design illustrated has been prepared.

In this design, the front end throttle valve is located between the superheater header and the stack. With this arrangement, the weight of the throttle valve and parts is approximately 700 lb. less than with a front end valve located ahead of the stack. The internal parts used with this arrangement are the same as in the standard Chambers front end throttle valve. The connection from the operating shaft to the throttle valve has been modified; however, a sliding stem with a stuffing box being used instead of the rotating shaft with a metallic steam tight joint.



General arrangement of the Chambers front end throttle valve located between the superheater header and the stack

News of the Month

Promotions and Appointments · I.C.C. · The Supply Trade · Club and Association News · New Trade Publications · New Shops

The Car Department of the Chicago & North Western established a record for the system during June when only six reportable injuries occurred among the 5,537 employees of the department. These employees worked 1,240,288 hours during that period.

New transportation degree at Yale

For the first time in history Yale University has granted a degree of Master of Science in Transportation Engineering. The recipient was Edmond Smith McConnell, who received his B.S. degree from the University of Minnesota in 1924. Mr. McConnell, who is on the staff of L. K. Sillcox, general superintendent of motive power of the Chicago, Milwaukee & St. Paul, spent one year at Yale where he held one of the Strathcona fellowships in transportation. His master's essay was on the subject of the Oil-Electric Locomotive.

Cost of fuel in May

The average cost of coal used as fuel for road locomotives in freight and passenger service by Class I railroads for the month of May was $2.64 a ton, as compared with $2.62 in May of last year, according to the Interstate Commerce Commission's monthly railroad fuel statistics. For the five months ended with May the average was $2.68 as compared with $2.63 last year. The average cost of fuel oil for the five months was 2.94 cents per gallon, as compared with 2.91 cents last year. The total cost of coal and fuel oil for the five months' period was $135,306,316, as compared with $135,668,384 for the corresponding period of last year.

Two day meeting of Southwest car men

About 200 members of the Southwest Master Car Builders' and Supervisor's Association met at Galveston, Texas, August 12 and 13 and in a live two-day session, gave earnest consideration to the problems confronting car men in that region. The meeting was called to order by President A. C. Wilson, general car inspector of the Missouri Pacific, and addresses were made by W. G. Choate, general manager of the Missouri Pacific and R. H. Innes, inspector, Bureau of Explosives. Committee reports on hot-boxes, transferring of cars, lighting passenger equipment, light freight car repairs and standard practice in cleaning passenger cars were discussed. The following individual papers were presented: Prevention of slid flat wheels, by J. P. Stewart, general supervisor of air brakes, Missouri Pacific; Interchange of cars, by C. J. Nelson, chief interchange inspector, Chicago; and Progressive system of repairing freight cars, by M. V. Dietz, general car foreman, Gulf Coast Lines.

A. A. E. condemns fake engineering correspondence schools

The American Association of Engineers, meeting at Tulsa, Okla., on June 6, adopted resolutions condemning questionable practices found in correspondence schools. The resolution declared that schools offering extension courses, and especially those specializing in engineering and professional subjects, should be required to operate under supervision and regulation equal to that now prescribed by federal law and state statutes for resident schools and other institutions of higher education.

A report of the association's correspondence school committee, which is based on a national survey, states that there are four times as many students enrolled in these correspondence schools as are in attendance at all colleges and universities. A large number of the schools offer obsolete courses of study and training in shops equipped with out-of-date machinery. Eighty per cent of the schools are privately owned or controlled and among the total of more than three hundred are companies with a capitalization of $10,000,000, employing staffs of 3,000 persons, including sales forces. Members of the association at the convention declared that such schools which undertake to develop an engineer in from three to six months, using the ability to pay for a course of study as the only requirement for entrance have a tendency to lower the standard of the engineering profession.

Famous locomotives at Baltimore exhibition

The locomotive "DeWitt Clinton" with its train—which flourished on the New York Central in 1831—has been sent to Baltimore to be a feature of the coming centenary celebration of the Baltimore & Ohio (September 24 to October 8); and the "John Bull" of the Camden & Amboy (New Jersey), said to be now the oldest complete locomotive in America, has been taken out of the Smithsonian Institution, at Washington, to be put in running order for the same celebration.

The "General," the famous locomotive which figured in the Andrews raid, in the Civil War, which for years past has been on exhibition in the passenger station of the Nashville, Chattanooga & St. Louis at Chattanooga, has also been sent to Baltimore, to be exhibited in the centenary celebration.

In addition the "King George V," the latest passenger locomotive of the Great Western (England), and the same road's historic "North Star," were shipped to this country from Cardiff on the SS. Chicago City on August 5.

B. & M. reorganizes mechanical engineer's department

Consistent with its general policy of reorganization in the mechanical department, the Boston & Maine has, under the direction of C. E. Barba, mechanical engineer, reorganized the department of the mechanical engineer. The department has been divided into three sections as follows:

Office of Mechanical Engineer

C. E. Barba....................Mechanical Engineer
S. J. Ra[illegible]....................Assistant Mechanical Engineer
W. B. Mochrie....................Office Engineer
G. F. Stevens........Assistant Engineer in Charge of Locomotive Design
E. W. Peterson............Assistant Engineer in Charge of Car Design
J. W. Pearley..Assistant Engineer in Charge of Shop Machinery, Tools, Jigs and Fixtures

Office of Electrical Engineer

L. C. Winship....................Electrical Engineer
E. K. Bless....................Assistant Electrical Engineer
P. J. Callahan....................Supervisor of Train Lighting

Office of Test Department

C. B. Smith....................Engineer of Tests
S. B. Dyer....................Assistant Engineer of Tests
J. J. Callahan....................Chief Chemist

This reorganization has several objectives. Better co-ordination of work will be attained as the three departments are headed by the mechanical engineer, who will be in a position to direct the activities of the departments which was not possible prior to the reorganization. The men listed are now all located at the principal locomotive repair shops of the B. & M. at Billerica, Mass., and not scattered at various points on the system. A modern well equipped testing laboratory will be located at Billerica. A 200,000-lb. testing machine has been installed and much more equipment is to be added in the near future.

A mathematical expert has been included on the staff, who

will make all the calculations required for the design of cars and locomotives, except those involved in boiler design, which will be made by a boiler supervisor who will be responsible for all the locomotive boilers on the system.

The new offices have been equipped with modern filing systems for correspondence, drawings and reports. A system has been worked out whereby each draftsman will have only one drawing at a time at his board.

Meetings and Conventions

The Drop Forge Supply Association will tender a dinner on Wednesday evening, September 21, to the visiting drop forgers who will be in attendance at the National Steel and Machine Tool Exposition that will be held at Detroit during the week of September 19. Tickets for this dinner, which will be held at the Harmony Club, will be issued by Pres. Chas. Harmon, who will be in the booth of the Chambersburg-National, Space Nos. 231 and 254.

Welding conference at the University of Minnesota

A conference embracing all phases of the welding industry is to be held at the University of Minnesota on October 20, 21 and 22, according to plans worked out by Prof. S. C. Shipley, acting head of the mechanical engineering department of the College of Engineering. Papers by practical users of welding equipment will be presented at this conference, the first of its kind to be held by the university, and roundtable discussions will be led by experts in their respective lines.

National Safety Council

The Steam Railroad Section of the sixteenth annual safety congress of the National Safety Council, which will be held at Chicago on September 26-30, will convene on September 27, 28 and 29. Addresses will be made by L. C. Fritch, vice-president of the Chicago, Rock Island & Pacific; R. C. White, assistant general manager of the Missouri Pacific; H. Johnson, president of the Duluth & Iron Range; L. A. Downes, president of the Illinois Central; L. F. Lorenz, director of the Bureau of Statistics of the Interstate Commerce Commission; and G. G. Dowdell, chief surgeon of the Illinois Central.

Fuels Division A.S.M.E. to hold its first national meeting

The Fuels Division of the American Society of Mechanical Engineers will hold its first national meeting at St. Louis, Mo., October 10 to 13, inclusive. A total of 26 papers, divided into four general classifications—namely, general industrial, power plant, and smoke abatement—will be presented during the four-day meeting. The following is a list of subjects of interest to railroad men on which papers will be presented:

Address on fuels, by S. W. Parr, professor of applied chemistry, University of Illinois, Urbana, Ill.
American fuel resources, by O. P. Hood, chief mechanical engineer, U. S. Bureau of Mines, Washington.
The clinkering of coal ash, by A. C. Fieldner, chief engineer of experiment stations, U. S. Bureau of Mines, Pittsburgh, Pa.
Factors governing the purchase of fuels, by Morgan B. Smith, engineer, General Motors Corporation, Detroit, Mich.
Application of powdered fuel to smaller boiler and industrial installations, by H. W. Brooks, consulting engineer, Erie City Iron Works, Erie, Pa.
The burning of liquid fuels, by Ernest H. Peabody, president, Peabody Engineering Corporation, New York.
The relative values of gaseous liquid and solid fuels, by F. C. Binnall, assistant manager, Standard Sanitary Manufacturing Company, New Brighton, Pa., formerly chemical engineer, General Oil and Gas Corporation.
Characteristics of modern boilers, by E. R. Fish, vice-president, Heine Boiler Company, St. Louis, Mo.
The measurement of atmospheric smoke pollution, visible and invisible, by Dr. Geo. T. Moore, director, Missouri Botanical Garden, St. Louis, Mo.
Smoke abatement methods used in Cleveland, by Col. Elliott H. Whitlock, commissioner of smoke inspection, Cleveland, Ohio.
Managing a smoke abatement campaign, by Erle Ormsby, president, Citizens' Smoke Abatement League, St. Louis, Mo.

G. N. stores officers hold convention

Over 50 storekeepers and other supply representatives of the Great Northern met in Havre, Mont., recently on the occasion of the fourth annual meeting of the Great Northern Stores' Association, which is organized and conducts its sessions on the same general plan as Division VI of the American Railway Association. Papers on Uniform Accounting Control of Line Stocks, Master Stock Books, Bin Pricing, Office Methods, Delivery of Material to Users, Handling Material, Budgeting Purchases, Shop Orders and Store Department Accounting were among those presented at this meeting. Practically every storekeeper on the Great Northern participated. The meeting resulted in the election of Robert Steel, district storekeeper at Great Falls, Mont., as chairman of the next year's meeting which will be held at a place to be determined upon later.

The following list gives names of secretaries, dates of next or regular meetings and places of meeting of mechanical associations and railroad clubs.

AIR-BRAKE ASSOCIATION.—T. L. Burton, 165 Broadway, New York.
AMERICAN RAILROAD MASTER TINNERS', COPPERSMITHS' AND PIPEFITTERS' ASSOCIATION.—C. Borcherdt, 202 North Hamlin Ave., Chicago.
AMERICAN RAILWAY ASSOCIATION DIVISION V.—MECHANICAL.—V. R. Hawthorne, 431 South Dearborn St., Chicago. Next meeting June 13 to 20, 1928, inclusive, Atlantic City, N. J.
DIVISION V.—EQUIPMENT PAINTING SECTION.—V. R. Hawthorne, Chicago. Convention Hotel Kentucky, Louisville, Ky., Sept. 13, 14 and 15.
DIVISION VI.—PURCHASES AND STORES.—W. J. Farrell, 30 Vesey St., New York.
AMERICAN RAILWAY TOOL FOREMEN'S ASSOCIATION.—G. G. Macina, 11402 Calumet Ave., Chicago.
AMERICAN SOCIETY OF MECHANICAL ENGINEERS.—Calvin W. Rice, 29 W. Thirty-ninth St., New York. Railroad Division, Marion B. Richardson, associate editor, *Railway Mechanical Engineer*, 30 Church St., New York.
AMERICAN SOCIETY FOR STEEL TREATING.—W. H. Eiseman, 4600 Prospect Ave., Cleveland, Ohio. Annual meeting, September 19-23, at Detroit.
AMERICAN SOCIETY FOR TESTING MATERIALS.—C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.
AMERICAN WELDING SOCIETY.—Miss M. M. Kelly, 29 West Thirty-ninth St., New York. Annual meeting September 19-23, at Detroit.
ASSOCIATION OF RAILWAY ELECTRICAL ENGINEERS.—Joseph A. Andrucetti, C. & N. W., Room 411, C. & N. W. Station, Chicago, Ill. Annual meeting, Hotel Sherman, Chicago, October 25-28.
BIRMINGHAM CAR FOREMAN AND CAR INSPECTORS' ASSOCIATION.—P. H. Gillean, 715 South Eightieth Place, Birmingham, Ala. Meeting, second Monday in each month at Birmingham, Y. M. C. A. Building.
CANADIAN RAILWAY CLUB.—C. R. Crook, 129 Charon St., Montreal, Que. Regular meetings, second Tuesday in each month, except June, July and August, at Windsor Hotel, Montreal, Que.
CAR FOREMEN'S ASSOCIATION OF CHICAGO.—Aaron Kline, 626 N. Pine Ave., Chicago, Ill. Regular meeting second Monday in each month, except June, July and August, Great Northern Hotel, Chicago.
CAR FOREMEN'S ASSOCIATION OF ST. LOUIS.—F. D. Wiegmar, 720 North 23rd St., E. St. Louis, Ill. Regular meeting first Tuesday in each month, except June, July and August.
CAR FOREMEN'S CLUB OF LOS ANGELES.—J. W. Krause, 514 East Eighth St., Los Angeles, Cal. Meeting second Friday of each month in the Pacific Electric Club Building, Los Angeles, Cal.
CENTRAL RAILWAY CLUB.—H. D. Vought, 26 Cortlandt St., New York. Regular meetings second Thursday each month, except June, July and August at Hotel Statler, Buffalo.
CHIEF INTERCHANGE CAR INSPECTORS' AND CAR FOREMEN'S ASSOCIATION.—(See Railway Car Department Officers' Association.)
CINCINNATI RAILWAY CLUB.—D. R. Boyd, 811 Union Central Building. Regular meeting second Tuesday, February, May, September and November.
CLEVELAND RAILWAY CLUB.—F. L. Frericks, 14416 Adler Ave., Cleveland, Ohio. Meetings first Monday each month, except July, August and September at Hotel Hollenden, East Sixth and Superior Ave., Cleveland.
INTERNATIONAL RAILWAY MASTER BLACKSMITHS' ASSOCIATION.—W. J. Mayer, Michigan Central, 2347 Clark Ave., Detroit, Mich.
INTERNATIONAL RAILWAY FUEL ASSOCIATION.—L. G. Plant Railway Exchange, 80 E. Jackson Boulevard, Chicago.
INTERNATIONAL RAILWAY GENERAL FOREMEN'S ASSOCIATION.—William Hall, 1061 W. Wabash Ave., Winona, Minn. Annual convention Chicago, September 6-9, 1927.
LOUISIANA CAR DEPARTMENT ASSOCIATION.—L. Brownlee, New Orleans, La. Meeting third Thursday in each month.
MASTER BOILERMAKERS' ASSOCIATION.—Harry D. Vought, 26 Cortlandt St., New York.
NEW ENGLAND RAILROAD CLUB.—W. E. Cade, Jr., 683 Atlantic Ave., Boston, Mass. Regular meeting second Tuesday in each month, excepting June, July, August and September, Copley-Plaza Hotel, Boston.
NEW YORK RAILROAD CLUB.—H. D. Vought, 26 Cortlandt St., New York. Meetings third Friday in each month, except June, July and August, at 29 West Thirty-ninth St., New York.
PACIFIC RAILWAY CLUB.—W. S. Wollner, 64 Pine St., San Francisco, Cal. Regular meetings, second Thursday of each month in San Francisco and Oakland, Cal., alternately.
RAILWAY CAR DEPARTMENT OFFICERS' ASSOCIATION.—A. S. Sternberg, Belt railway, Clearing Station, Chicago. Annual convention Hotel Sherman, Chicago, August 23, 24 and 25.
RAILWAY CLUB OF GREENVILLE.—Paul A. Minnis, Bessemer & Lake Erie, Greenville, Pa. Meeting last Friday of each month, except June, July and August.
RAILWAY CLUB OF PITTSBURGH.—J. D. Conway, 515 Grandview Ave., Pittsburgh, Pa. Regular meeting fourth Thursday in month, except June, July and August. Fort Pitt Hotel, Pittsburgh, Pa.
ST. LOUIS RAILWAY CLUB.—B. W. Frauenthal, Union Station, St. Louis, Mo. Regular meetings, second Friday in each month, except June, July and August.
SOUTHERN AND SOUTHWESTERN RAILWAY CLUB.—A. T. Miller, P. O. Box 1205, Atlanta, Ga. Regular meeting third Thursday in January, March, May, July, September and November.
TEXAS CAR FOREMEN'S ASSOCIATION.—A. I. Parish, 106 West Front St., Fort Worth, Tex. Regular meetings first Tuesday in each month, Terminal Hotel bldg., Fort Worth, Tex.
TRAVELING ENGINEERS' ASSOCIATION.—W. O. Thompson, 1177 East Ninety-eighth St., Cleveland, Ohio. Annual meeting Hotel Sherman, Chicago, September 13-16, 1927.
WESTERN RAILWAY CLUB.—W. J. Dickinson, 189 West Madison St., Chicago. Regular meetings, third Monday in each month, except June, July and August.

Supply Trade Notes

The Harnischfeger Corporation, Milwaukee, Wis., has opened a branch office at 330 Gateway Bank building, Minneapolis, Minn.

The T-Z Railway Equipment Company, 14 East Jackson boulevard, Chicago, has been appointed Chicago representative of the Graham-White Sander Corporation, Roanoke, Va.

The Pullman Car & Manufacturing Corporation has let a contract to Moreno, Lemle & Lemle, New Orleans, La., for the construction of the first unit of a car wheel plant, 200 by 400 ft., in that city.

The Ingersoll-Rand Company, New York, has opened a branch office at 236 High street, Newark, N. J. F. K. Armstrong, formerly connected with the company's New York sales branch, has been appointed manager.

The American Rolling Mill Company, Middletown, Ohio, has purchased the Columbia Steel Company and the Forged Steel Wheel Company of Pittsburgh, Pa., subsidiaries of the Standard Steel Car Company.

A. A. Hale, eastern sales manager of the Griffin Wheel Company, New York, has been elected vice-president, with the same headquarters. F. B. Flim, sales agent, with headquarters at Chicago, Ill., has been transferred to Cleveland, Ohio.

W. H. S. O'Brien, formerly with the Waugh Equipment Company, has joined the staff of the O'Fallon Company, St. Louis, Mo. Mr. O'Brien's headquarters are at St. Louis. He will be engaged in general sales and service work among transportation companies in the southwest territory.

The Earle Gear & Machine Company, Philadelphia, Pa., has opened a district office at 95 Liberty street, New York City; C. N. Walsh and George E. Barrtett are in charge. The company also maintains a district office in charge of William H. Allen at 110 State street, Boston, Mass.

The Waugh Equipment Company, Chicago, has appointed the O'Fallon Company, Arcade building, St. Louis, Mo., as exclusive representative to handle sales and distribution of the Waugh company's various specialties to railroads and electric lines, in St. Louis and the middle west section of the United States.

John A. Toleik has been appointed chief engineer of the Gibb Welding Machine Company, Bay City, Mich. Mr. Toleik was formerly in charge of all welding developments of the American Can Company. His chief interest with the Gibb Welding Machine Company will be in the further development of its research department.

The Westinghouse International Brake & Signal Company has been incorporated in Delaware, with a capitalization of 1,000,000 shares of no-par stock. The new company has been organized to acquire the Westinghouse Air Brake business now operated by separate companies in England, France, Italy, Canada and New South Wales.

The Hyatt Roller Bearing Company, Newark, N. J., has appointed the O'Fallon Company, Arcade building, St. Louis, Mo., its direct sales representative. The O'Fallon Company will handle exclusively the Hyatt railroad journal box and roller bearings for steam railroad and electric railway use in the central southwest territory from its St. Louis sales office.

In connection with recent newspaper reports relative to merging the General American Tank Car Company and the Pressed Steel Car Company, F. N. Hoffstot, president of the Pressed Steel Car Company, has issued a statement to the effect that no such proposition had ever been put up to the directors or the stockholders of the Pressed Steel Car Company, Pittsburgh, Pa.

W. R. Bean, formerly research engineer of the Eastern Malleable Iron Company, Naugatuck, Conn., has entered the employ of the Grindle Fuel Equipment Company, Harvey, Ill., a subsidiary of the Whiting Corporation, as vice-president and consulting engineer. Mr. Bean will handle both sales and engineering problems in connection with the application of pulverized coal to steam boilers, furnaces or other steam producing units requiring such equipment.

The shops and engineering department of the Miller Train Control Corporation have been moved from Danville, Ill., to Staunton, Va., where the home office of the company is located, and where P. X. Rice, electrical engineer, will be in charge of the electrical department and research work. W. B. Murray, chief engineer, has also been assigned to the position of sales engineer, with headquarters at the Washington, D. C., office.

The Heald Machine Company of Worcester, Mass., has acquired the grinding machine interests of the Giddings & Lewis Machine Tool Company, Fond du Lac, Wis. The purchase includes all the assets of the grinding machine division of the Giddings & Lewis Machine Tool Company, including drawings, patterns, jigs, tools and fixtures, inventory of machines and parts, patent rights and good will. The Giddings & Lewis Company will now devote its entire efforts to the manufacture and development of the combination horizontal boring, drilling and milling machines.

The Foos Gas Engine Company, Springfield, O., has changed its name to the Foos Engine Company. The following officers have been elected: J. F. Baker, president; M. E. Baker, secretary-treasurer; Ray C. Burrus has been appointed sales manager; W. W. Schettler has been appointed chief engineer, and George F. Noltoin mechanical engineer. The company will establish a factory branch at Tulsa, Okla., and the branch staff will include sales representatives and service engineers. Garvey & Palmer, Inc., who are the company's Pacific Coast representatives, have established offices in Los Angeles, San Francisco and Seattle.

The Economy Equipment Corporation, the LaClede-Christy Clay Products Company, the A. P. Green Fire Brick Company and the Evens & Howard Fire Brick Company have organized the Economy Arch Company, with offices in the Railway Exchange building, St. Louis, Mo., and Broad Exchange building, New York City, for the manufacture, sale and service of Economy locomotive arch and furnace brick. The officers of the company are as follows: J. C. Chapple, president; A. F. Stark, vice-president, and W. J. Westphalen, secretary-treasurer. The directors are: J. L. Green, C. H. Green, A. P. Green, J. C. Chapple, A. F. Stark, and J. E. Ames.

The Bethlehem Steel Company has established three divisions of sales, each in charge of a vice-president as follows: General sales, E. S. Knisely, vice-president, and Paul Mackall, general manager of sales. Structural and plate sales, including fabrication and erection of buildings and bridges, G. H. Blakeley, vice-president, and E. E. Goodwillie, general manager of sales. Railway freight and passenger car and machinery sales, G. W. Struble, vice-president. In addition to the above changes J. M. Gross is now vice-president in charge of traffic; H. C. Crawford is traffic manager; R. E. McMath is vice-president in charge of finances and will also retain the office of secretary; all with headquarters at Bethlehem, Pa.

The St. Louis Car Company, St. Louis, Mo., is completing a new steel fabricating and erecting shop of modern type, 1,000 ft. long and 135 ft. wide, built in two bays with two 10-ton traveling cranes in each bay. The shop is well lighted, it is of steel construction, erected on a low concrete foundation and the sides and roof bays are glazed with Fenestra steel sash. Raw material, steel plates and shapes are protected from the weather in a completely enclosed building, constructed for the purpose, forming an L at the lower end of the shop, and this building is also equipped with an overhead crane and runway for handling materials. Shears, presses and punches are at the lower end of the shop where the material is prepared for fabrication. There are four tracks on which the cars are erected, being built on steel jigs on concrete bases, perfectly aligned and surfaced for accurate construction Either freight cars or passenger equipment can be pro-

duced. When these cars are turned out at the upper end of the building they are ready for the finishing and paint shops.

J. F. Craig, for four years representative of the Westinghouse Air Brake Company at New York, has been promoted to assistant eastern manager. Mr. Craig was graduated from Cornell University with the mechanical engineering class of 1912. He entered the experimental department of the Westinghouse Air Brake Company in 1913, and left the company in 1916 for a time to engage in engineering work and to serve in the army during the war. He returned to the service of the Westinghouse Air Brake Company in 1920 as special engineer, with headquarters at Pittsburgh, Pa., and was transferred to the New York office as representative in 1923. H. B. Gardner has been appointed assistant to the resident vice-president of the Westinghouse Air Brake Company at New York. Mr. Gardner was graduated from Union College, Schenectady, N. Y., as a mechanical engineer in 1916. He served several years with the Locomotive Stoker Company in mechanical and commercial activities, and entered the employ of the Westinghouse Air Brake Company in 1923 as representative. In 1926 he was appointed vice-president of the Westinghouse Friction Draft Gear Company, with headquarters at Chicago, and now leaves that position to take his new appointment as above noted in the parent organization. N. M. Forsythe, inspector in the automotive division of the Westinghouse Air Brake Company at St. Louis, Mo., has been appointed representative of the automotive division at Pittsburgh, Pa., and P. B. McGinnis, who resigned in 1925 as representative of the Westinghouse Air Brake Company at Chicago to go with an automotive company, has returned to the Westinghouse organization as representative of the Westinghouse Friction Draft Gear Company, with headquarters at Chicago.

Manning, Maxwell & Moore, Inc.

To set at rest various rumors concerning the activities and intentions of Manning, Maxwell & Moore, Inc., President C. A. Moore, Jr., of that company, has furnished the following facts:

"The manufacturing activities of Manning, Maxwell & Moore, Inc., have grown to be so important since the war that the company decided to go out of the general machine tool jobbing business, retaining only such selected outside lines of machine tools and for such territories as fitted in with the most efficient handling of our own products.

"This change was made both for our own advantage and for the advantage of the manufacturers whose lines we had handled for many years, most of whom have since adopted the policy of selling direct through their own sales forces.

"In our opinion the machine tool business has changed so profoundly since the war that a far greater expert knowledge of the lines sold is demanded of sales representatives.

"This can only be secured by salesmen handling fewer lines, on which they must concentrate. In handling its own products, together with the few outside lines retained, Manning, Maxwell & Moore, Inc., is more actively in the machine tool business than ever before in its history.

"The Putnam Machine Company, owned and operated by Manning, Maxwell & Moore, Inc., has added the Detrick & Harvey and the Beaman & Smith lines to its own extensive lines of heavy industrial and railroad tools.

"The Shaw Crane Company plant at Muskegon, Mich., also owned and operated by Manning, Maxwell & Moore, Inc., is manufacturing important mechanical products besides overhead electric cranes—widening its field, as are the Hancock Inspirator Company, the Ashcroft Manufacturing Company and the Consolidated Safety Valve Company, which are also owned and operated by Manning, Maxwell & Moore, Inc.

"The company is also carrying on a very extensive machine shop, railroad and mill supply business, a department wholly independent of its many manufacturing activities."

Atchison, Topeka & Santa Fe.—A contract has been let to McClintic-Marshall Co., of Pittsburgh, Pa., for the construction of shop buildings at Cleburne, Texas. This work involves the use of about 2,800 tons of steel.

Trade Publications

Air compressors.—The Pennsy-portable air compressor, Model 121, is illustrated and described in Bulletin No. 133 of the Pennsylvania Pump & Compressor Company, Easton, Pa.

Welding equipment.—The safety construction features of the Torchweld welding and cutting torches are illustrated in a 32-page booklet of welding and cutting equipment issued by the Torchweld Equipment Company, Chicago.

Fuzon welding.—The more important items of Fuzon equipment and supplies for metallic arc welding are briefly described in a 24-page brochure entitled "Redesign Engineering," issued by the Fusion Welding Corporation, One Hundred and Third street and Torrence avenue, Chicago.

Feedwater heaters.—Bulletin No. 103 descriptive of Webster feedwater heaters of genuine puddled wrought iron has been issued by Warren Webster & Co., Camden, N. J. These heaters are provided in four different series in a total of 25 standard size units, and are of rectangular and cylindrical designs.

Welders.—The advantages of the dynamotor type of construction used in Una welders are described in Bulletin No. 121 issued by the Una Welding & Bonding Company, 1615 Collamer avenue, Cleveland, Ohio. The Una welder is designed so that the full capacity of the machine may be obtained with either a metallic or carbon electrode.

American multiple throttle.—A brief description of the American multiple throttle, its operation and maintenance, is contained in Bulletin No. 2 issued by the American Throttle Company, 17 East Forty-second street, New York. The same information has also been issued as a wall chart, 25 in. by 27. in., suitable for use in roundhouses.

Welding and cutting equipment.—Information and suggestions for the use and care of welding and cutting equipment are contained in catalogue No. 27 issued by the International Oxygen Company, Newark, N. J. The welding and cutting apparatus described and illustrated in this catalogue are of the Eyeosee and International types.

Mechanical engineering courses.—The Rensselaer Polytechnic Institute, Troy, N. Y., in its March, 1927, bulletin, describes the curriculum of its undergraduate course in mechanical engineering and its graduate courses, and shows some of the machinery and apparatus in its laboratories and the wide fields open for work in the mechanical engineering profession.

Flexible metal hose.—Seamless flexible metal hose, designed for use as a flexible conveyance of non-solids and non-abrasives and for flexing and expansion between delivery and receiving connections at moderate and very high pressures and temperatures, is described in Bulletin No. 201-29-C issued by Chas. Cory & Son, Inc., 185 Varick street, New York.

Coffin feedwater heater system.—Instructions for the operation and maintenance of the Coffin feedwater heater system are given in Instruction Book No. 201 issued by the J. S. Coffin, Jr., Company, Trust Company building, Jersey City, N. J. Charts show the diagrammatic arrangement of the feedwater heater system and the method of replacing leaking tubes.

Milling practice.—A talk of milling cutter efficiency given by A. N. Goddard before a recent meeting of the Southern and Southeastern Railroad Club at Atlanta, Ga., has been published in booklet form by Goddard & Goddard, Detroit, Mich. Mr. Goddard describes a machine tool as a mechanism for holding a piece of work and, at the same time, tooling certain of its surfaces. He then empasizes the importance of the small cutting tool, giving figures to show the savings that can be effected by the use of tools of good design, temper and workmanship. Who selects and purchases machine tools for the railroads is then discussed, also the principle of cutting metals and the simultaneous development of tool steel having alloys of tungsten, chromium and vanadium.

Personal Mention

General

Harry T. Bentley has retired as general superintendent of motive power of the Chicago & North Western at Chicago. Mr. Bentley was born in London, England, on June 4, 1862, and attended Dulwich college. He entered railway service at the age of 15 as a machinist's apprentice on the London & North Western of England (now a part of the London, Midland & Scottish) and in 1887 he was promoted to foreman of the enginehouse at Chester, England. He severed his connection with the L. & N. W. in 1892 when he came to the United States and entered the service of the Chicago & North Western as a machinist in the Chicago shops. After a short period at Chicago he was promoted to foreman in the shops at Boone, Iowa, being transferred to Belle Plaine, Iowa, in 1895 and promoted to general foreman of shops at Clinton, Iowa, in 1898. During the same year Mr. Bentley was promoted to master mechanic of the Madison division and on December 30, 1899, he was transferred to the Iowa division, where he remained until August 31, 1902, when he was further promoted to assistant superintendent of motive power and machinery, with headquarters at Chicago. On October 31, 1913, he was promoted to superintendent of motive power and machinery, with headquarters at Chicago, becoming general superintendent of motive power and machinery on May 1, 1922. During the period from February 2, 1918, to June 19, 1918, Mr. Bentley served as assistant director of transportation of the United States Railroad Administration in charge of mechanical matters, with headquarters at Washington, D. C. In this capacity he acted as chairman of the committee organized to prepare plans and specifications for standard locomotives and cars. Mr. Bentley was president of the American Railway Master Mechanics' Association in 1911-1912, president of the International Railway Fuel Association in 1912-1913, first vice-president and president of the Western Railway Club in 1905-1906 and 1906-1907 respectively and chairman of the Committee on Locomotive Design and Construction, Mechanical Division of the American Railway Association, from 1923 to 1927.

H. T. Bentley

Master Mechanics and Road Foremen

Edward B. LeVan has returned to the position of road foreman of engines of the Northern Pacific at Missoula, Mont., after a leave of absence because of illness.

Harry C. Allen, formerly road foreman of engines of the Northern Pacific at Missoula, Mont., has been transferred to the position of road foreman of engines at Forsyth, Mont.

A. W. Standiford, master mechanic of the Illinois St. Louis division of the Chicago & Eastern Illinois, has been transferred to the Chicago division, with headquarters at Danville, Ill.

Charles Furness has been appointed master mechanic of the Portland division of the Boston & Maine, with headquarters at East Somerville, Mass., to succeed John W. McVey, resigned.

J. N. Chapman, general foreman in the locomotive department of the Illinois Central at New Orleans, La., has been appointed master mechanic, with headquarters at McComb, Miss., succeeding E. C. Roddie.

The jurisdiction of J. L. Butler, master mechanic of the Illinois division of the Missouri Pacific, has been extended to cover the Missouri division and his headquarters have been shifted from Dupo, Ill., to Poplar Bluff, Mo.

E. J. Wegmiller, master mechanic of the Evansville division of the Chicago & Eastern Illinois, at Evansville, Ind., has been transferred to the Illinois-St. Louis division, with headquarters at Salem, Ill., succeeding A. W. Standiford.

R. A. Whitsitt, assistant master mechanic of the Tennessee Central, has been appointed master mechanic, with headquarters at Nashville, Tenn., succeeding E. L. Mauk, deceased. Mr. Whitsitt was born at Nashville, Tenn., on August 6, 1888. He entered railway service in 1903 as a machinist apprentice on the Nashville, Chattanooga & St. Louis. He was employed consecutively as a machinist on the Tennessee Central and Louisville & Nashville from September, 1909, until November, 1916, when he returned to the Tennessee Central where he has since held the positions of roundhouse foreman, general foreman and assistant master mechanic. The position of assistant master mechanic has been abolished.

Shop and Enginehouse

B. Pendleton has been appointed general foreman of the Carleton Place shop of the Canadian Pacific, with headquarters at Montreal, Que.

E. C. Roddie, master mechanic on the Illinois Central, at McComb, Miss., has been appointed superintendent of shops, with headquarters at Paducah, Ky., a newly created position.

C. J. Bodemer has been appointed acting superintendent of machinery of the Louisville & Nashville with headquarters at Louisville, Ky., and is to have full charge of the mechanical department during the illness of C. F. Giles.

Car Department

Charles T. Reynolds has been appointed general foreman of the Central of New Jersey at the Elizabethport, N. J., freight car repair shop.

William Alter has been appointed general foreman, in charge of passenger car repairs, of the Central of New Jersey, with headquarters at Elizabethport, N. J.

John H. Thackston has been appointed car foreman of the Chicago & Alton, with headquarters at Brighton Park, Ill., succeeding Edward Pendleton, resigned.

T. A. Saunders, general foreman of the car department of the Tennessee Central at Nashville, Tenn., has been appointed master car builder, with headquarters at the same point. Mr. Saunders was born in Buckingham County, Virginia, on June 6, 1867. He entered railway service on September 22, 1889, as a car repairer on the Chesapeake & Ohio at Huntington, W. Va. In July, 1903, he became a foreman in the car department of the Illinois Central at Paducah, Ky.; in March, 1913, general foreman of the Tennessee Central at Emory Gap, Tenn., and in October, 1917, general foreman of the car department at Nashville.

Purchases and Stores

Frank S. Austin, general storekeeper of the Boston & Albany, with headquarters at West Springfield, Mass., has been appointed purchasing agent, with headquarters at Boston, Mass., succeeding Frederic A. Ryer, who has retired. Mr. Austin was born on November 6, 1886, at Lynn, Mass., and was educated at Dartmouth College and Thayer School of Civil Engineering. He entered railway service on May 31, 1909, as a chainman on the Boston & Albany, and until 1910 was consecutively rodman, transitman and in charge of party surveys. From 1910 until 1913, he was assistant supervisor of tracks at Pittsfield and Springfield, Mass., and from 1913 until 1917 was supervisor of track at Worcester and Boston, Mass. In 1917 he was appointed general storekeeper, which position he was holding at the time of his recent appointment as purchasing agent.